"A STUDY OF COMPLICATIONS OF VARIOUS TYPES OF HERNIAS IN OUR INSTITUTION''

Dissertation submitted to

THE TAMILNADU Dr. M. G. R. MEDICAL UNIVERSITY

in partial fulfillment of the regulations for the award of the degree of

M. S. GENERAL SURGERY (BRANCH I)

CHENGALPATTU MEDICAL COLLEGE

THE TAMILNADU Dr. M. G. R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

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CERTIFICATE

This is to certify that this dissertation titled **"A STUDY OF COMPLICATIONS OF VARIOUS TYPES OF HERNIAS IN OUR INSTITUTION''** has been prepared by **DR. V.VIJAYABHASKER**, under my supervision in the Department of General Surgery, Chengalpattu Medical College, Chengalpattu, during the academic period 2011 – 2014, and is being submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the University regulation for the award of the Degree "Master Of Surgery" (M. S., General Surgery) and his dissertation is a bonafide work.

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DECLARATION

I, **Dr.V.VIJAYABHASKER**, solemnly declare that the dissertation**"A STUDY OF COMPLICATIONS OF VARIOUS TYPES OF HERNIAS IN OUR INSTITUTION"**a bonafide work done by me in the Department of General Surgery, Chengalpattu Medical College, Chengalpattu, Under the able guidance of **Prof. Dr.M.V.UDAYA CHANDAR. M.S**, Proffessor , Department of General Surgery , Chengalpattu Medical College , Chengalpattu .

Place: Chengalpattu. **(DR.V.VIJAYABHASKER)**

Date:

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CONTENTS

CHARTS

LIST OF ABBREVIATIONS

DM	-	DIABETES MELLITUS
SHT	-	SYSTEMIC HYPERTENSION
CAHD	-	CORONARY ARTERY HEART DISEASE
COPD	-	CHRONIC OBSTRUCTIVE PULMONARY DISEASE
BPH	-	BENIGN PROSTATIC HYPERTROPHY
BMI	-	BODY MASS INDEX

INSTITUITIONAL ETHICS COMMITTEE

CHENGELPETTU MEDICAL COLLEGE&HOSPITAL, CHENGELPETTU

APPROVAL OF ETHICAL COMMITTEE

TO

Dr. Vijayabhasker. V.

Dear Dr.

The Institutional Ethical committee of Chengalpattu Medical College & Hospital reviewed and discussed your application to conduct the clinical trial /dissertation work entitled

A Study of Complication in Various types of Hernias in our Institution

On--14/2/13---------

The following documents reviewed

a. Trial protocol, dated----------version no
b. Patient information sheet and informed consent form in English and/or vernacular language.
c. Investigators Brochure ,dated----------version
d. Principal investigators current
e. Investigators undertaking

The following members of the Ethics committee were present at the meeting held on

Date -14/2/13----------time----1:20pm----place----Chengalpattu Medical College

Ja Rom
14.2.13.
----------Chairman Ethics committee

14/2/13
----------member secretary of Ethics committee

Name of each member with designation

Biological scientist

Clinical member

1

2.

Nonclinical member

Lawyer

Member from nongovernment voluntary

Organisation

Philosopher

Lay person

We approve the clinical trial to be conducted in its presented form

The Institutional Ethics committee expects to be informed about the progress of the study, and any SAE occurring in the course of the study, any changes in protocol and patient information/informed consent and asks to provide copy of final report.

Yours sincerely

14/2/17

Member secretory, Ethics committee

Abstract

Inguinal hernia repair is one of the most commonly performed in every general surgery department . In our hospital about 300 to 400 inguinal hernia repairs are performed every year. Majority of the hernia repairs are performed electively and few are done as an emergency procedure. The complications associated with inguinal hernias and the post operative complications are not uncommon . In our study most of the pre-operative complications are associated with long standing hernias and recurrent hernias. Post operative complications like seroma and hematoma commonly occurred in patients with BMI more than 30. Smokers are associated with increased rate complications than the non smoking counterparts . Long standing inguino-scrotal hernias are associated with complications like seroma, funiculitis, orchitis, testicular atrophy. Both pre-operative and post-operative complications are more frequent in indirect inguinal hernias than the direct inguinal hernias.

Methods

A prospective clinical study of 200 inguinal hernia patients are selected randomly was done . They are stratified and followed up for a duration of two years. Their associated co-morbidities and social habits and anthropometry and the associated complication at diagnosis are recorded . The intra-operative complications and the short term complications are recorded

Results

In our study patients with inguinal hernias are grouped into three categories based on the age group. In patients belonging to the < 40 years group 6 patients had direct inguinal hernia , 46 patients had indirect inguinal hernias , 1 patient had

recurrent inguinal hernia , 2 patients had bilateral inguinal hernias ,4 patients had pantaloons hernia.

In patients belonging to the age group of 40 to 60 years, 27 patients had direct inguinal hernia, 72 patients had indirect inguinal hernia , 5 patients had recurrent inguinal hernia, 4 patients had bilateral inguinal hernia,and 14 patients had pantaloons hernia.

In patients belonging to the group > 60 years , 21 patients had direct inguinal hernia 28 patients had indirect inguinal hernias ,6patients had recurrent inguinal hernias,8 patients had bilateral hernias ,3 patients had pantaloons hernia.

In our study a total of 200 inguinal hernia patients were included . 52 patients (26%) were in the age group of less than 40 years . 99 patients(49.5%) were in the age group of 40 to 60 years . 49 patients (24.5%) of the patients were in the age group of more than 60 years.

In our study 54(27%) patients had direct inguinal hernia, 146(68%) patients had indirect inguinal hernia. 12(6%) patients had recurrent inguinal hernia. 139(69.5%) patients had right inguinal hernia and 61(30.5%) patients had left inguinal hernias , 16(8%) patients had bilateral inguinal hernia.

In our study out of 200 patients 196(98%) patients were males and 4(2%) patients were females . out of the 4 female patients 1(25%) patient had direct inguinal hernia and 3(75%) patients had indirect inguinal hernias , all the female patients had right inguinal hernia(100%).

In our study 92 (46%) out of 200 patients presented with symptoms for less than one year , 108 patients (54%)had symptoms for more than one year

In our study. 86 patients (43%) had inguinal swelling. 117 patients (58.5%) had inguino scrotal swelling . 67%% (37)of the patients with direct hernia had inguinal swelling and 33 %(18) of the patients with direct hernia had inguino scrotal swelling. 34%(49) of the patients with indirect hernias has inguinal swelling. 66% (96) of the patients with indirect inguinal hernias has inguino scrotal hernias.

32% of the patients had BMI 20 – 25. 56% of the patients had BMI 25-30 .

12% of the patients had BMI 30 – 35.

In our study 32% of the patients are smokers , 27% are alcoholics . 22% are both smoker and alcoholic and 19% of the patients are nonalcoholic and nonsmokers .

18% (36)of the patients had diabetes mellitus . 22%(43) of the patients had systemic hypertension . 14% (28) of the patients had coronary artery heart disease. 26% (52) of the patients had chronic obstructive pulmonary disease. 20% (40)of the patients had benign prostatic hypertrophy.

50% (12) of the of the pre-operative complications was due to incarceration. 33%(8) of the pre-operative complications was due to obstruction . 17% (4) of the complications was due to strangulation .

17%(4) of the patients are less than 40 years old. 54%(13) of the patients are in the age group of 40 – 60 years. 29%(7) of the complications are in the age group of more than 60 years.

75% (9) of the incarcerated hernia are right inguinal hernia . 25% (3) of the incarcerated hernia are left inguinal hernia . 87.5%(7) of the obstructed hernias are right inguinal hernia. 12.5%(1) of the obstructed inguinal hernia are left inguinal

hernia. 75% (3) of the strangulated hernias are right and 25%(1) of the strangulated hernias are left.

58%(14) of the complicated hernias had hernias for more than one year. 42%(10) of the complicated hernias had hernia for less than one year.

83%(10) of the incarcerated hernias had hernia for more than one year. 17%(2) of the incarcerated hernias had hernia for less than one year. 75%(6) of the obstructed hernias had hernia for less than one year, and 25%(2) of the obstructed hernias had hernia for more than one year. 100%(4) of the strangulated hernia patients had hernia for less than one year.

96% (23) of the complicated inguinal hernias are inguino scrotal . 4%(1) of the pre-operative complications had bubonocele.

0.7% (1) of the complications are vas injury. 11%(15) of the complications are vessel injury. 9%(13) of the complications are nerve injury.

8%(11)of the complications are due to urinary retention . 7%(10) of the complications are due to hematoma . 14%(20) of the complications are due to seroma.6%(8)of the complications are due to wound infection. 16%(22)of the complications are to funiculitis . 1%(2) of the patients are due to orchitis .

3.6%(5) of the complications are due to seroma . 2%(3) of the complications are due to hematoma . 0.7%(1) of the complication are due to infection. 10%(14) of the complications are due to inguinodynia. 19.4%(27) of the complications are due to sensory disturbance. 1.4%(2) of the complications are due to recurrence. Orchitis, testicular atrophy , hydrocele , entero-cutaneous fistula each contribute to 0.7% of the complications each.

9% of the complications are intra operative , 57% of the complications are short term complications . 34% of the complications are long term complications .

71% of the complications occurred in patients with hernia more than one year. 29% of the complications occurred in patients with hernia less than one year.

67% of the complications occurred following repair of inguino scrotal hernias. 33% of the complications occurred following bubonocele repair.

20%(23) of the complications occurred in patients with BMI 20 -25.

58%(80) of the complications occurred in patients with BMI 25 – 30.

22%(31) of the complications occurred in patients with BMI 30 -35.

56% (78) of complications occurred in smokers . 39%(54) of the complications occurred in alcoholic . 26%(36) of the complications occurred in patients who do not smoke or drink.

19%(26) of the complications occurred in patients less than 40 years of age. 49%(68) of the complications occurred in patients who are 40 -60 years of age . 32%(44) of the complications occurred in patients more than 60 years .

59%(81) of the complications occurred in indirect hernias . 31%(43) of the complications occurred in patients with recurrent inguinal hernia. 10%(14) of the complications occurred in patients with direct inguinal hernia.

15%(21) of the complications occurred in patients with diabetes mellitus. 11%(15) of the complications occurred in hypertensive patients . 8%(11) of the complications occurred in patients with coronary artery heart disease. 13%(18) of the complications occurred in patients with chronic obstructive pulmonary disease. 14%(20) of the complications occurred in patients with Benign prostatic

hypertrophy. 5%(7) of the complications occurred in patients with other co-morbidities. 33% (139) of the complications occurred in patients without any co-morbid illness.

Conclusion

- 31%(62) of the patients developed complications
- Totally 139 complications are reported on follow up of 200 patients for a period of 2 years
- Nerve injury is the most common intra operative complication
- Vascular injury is the 2nd common intra operative complication
- Funiculitis is the most common short term complication in our study
- Funiculitis commonly occurred in patients with inguino- scrotal hernias and in hernias of longer duration
- Seroma is the 2nd common short term complication in our study
- Seroma is common in patients with BMI > 25
- Wound infection is common in diabetic patients and in patients with BMI > 25
- Haemotoma is common in hypertensive patients and in patients with BMI > 25
- Orchitis , nerve injury , vessel injury are common in recurrent inguinal hernias had in patiets with large inguino scrotal hernias
- Chronic groin pain is common in the age group 40- 60 years .

- Patients with intra operative nerve injury had post operative sensory disturbances in the groin region.
- Smokers had increased incidence of complications than non smokers .
- 1% of the patients had inguinal hernia recurrence .
- Under weight and smoking are important risk factors in the development of recurrence .
- Patients with strangulation or obstruction had hernias for less than one year
- Patients with incarceration had inguinal hernia for more than one year duration
- Incarceration was the most common pre operative complication
- 12% of the patients had pre operative complications
- Incarceration is the most common pre operative complication
- Right inguinal hernias contribute to 80 % of all pre operative complications
- 96 %of the pre operative complications occurred in inguino sctotal hernias.
- Incarcerated hernias commonly occurred in patients with chronic cough and Benigh Prostratic Hypertrophy with significant urinary tract obstruction .
- Pre operative complications commonly occurred in patients in the age group of 40 to 60 years

Key words

Inguinal hernia, body mass index, seroma, hematoma, orchitis, funiculitis , testicular atrophy

INTRODUCTION

Hernia is the abnormal protrusion of whole or part of viscous through an abnormal opening . Hernias are known to mankind since very ancient times , and several treatment modalities were tried . The treatment of hernias hasevolved much since then .Complications associated with inguinal hernias and its treatment are well known.

There are several types of hernias , inguinal hernia, femoral hernia , ventral hernia, scar hernia , lumbar hernia , perineal hernia , internal hernias etc, Inguinal hernia contributes to more than 90 % of all hernias. Inguinal hernias are encounterd in everyday life of a general surgeon and undoubtfully they are one of the first learned surgeries for many surgeons. Inguinal hernia repair is one of the commonly performed surgeries world wide . Complications of untreated inguinal hernias and post-operative complications of inguinal hernias are not uncommon . These complications cause significant morbidity to the patients and increases the duration of hospital stay and expenditure.

A thorough knowledge of the complications of the inguinal hernias and their causes and associations will help us to avoid unwanted morbidity for the patients and can reduce the expenditure and duration of hospital stay.

OBJECTIVE OF THE STUDY

To study the incidence of pre-operative complications and its pre-disposing factors of inguinal Hernias.

To study the incidence of post-operative complications of inguinal hernias repairs and to know their predisposing factors.

REVIEW OF LITERATURE

The word hernia is derived from a Greek word “hernios” meaning to “bud’’ or “shoot”.

The history of inguinal hernia surgery dates very long back.[20]

In 1500BC , inguinal hernia was described in an Egyptian papyearus. Inguinal hernia was depicted in an Greek statuette[1].

In 1215 BC first historic evidence of surgical treatment of inguinal hernia in the mummified remnants of Pharaoh Meneptah[1]

In 900 BC tight fitting bandages were used to treat hernias in Alexendria[1]

In 400 BC Hippocrates differentiated hernia and hydrocele by reducibility and transillumination [1]

In 40 AD Celsus described in detail about hernias and various surgical treatments in Greek[1]

In 40 AD reduction of the contents of the hernia and applying clamps to produce inflammation is considered as the treatment of inguinal hernias[1]

In 129-201 AD Galen described the anatomy of abdominal musculature in detail . He also described that hernia is due to failure of tissues of the abdominal wall[1.]

In 625-900 AD ligation of sac was considered as the treatment of hernias[1]

In 700 Ad Paul of Aegina distinguished direct and indirect inguinal hernias, he also described orchidectomy as the treatment of hernias[1.] In 1363 Guy de Chaulic differentiated between femoral and inguinal hernias. He also described Trendelenberg procedure for the treatment of strangulated inguinal hernias[1].

In 1559 Stromayr distinguished between direct and indirect inguinal hernias and described separate treatment methods for each of them[1].

In 1561 Franco introduced "punctum aurium" identification of the hernia sac at the root of the scrotum and its ligation using gold thread[1].

During the 17th century the knowledge of anatomy of the inguinal region increased and surgeons were able to deliver better treatment for inguinal hernias[1].

In 1700 Littre described Meckel's diverticulum in hernia sac[1] In 1731 De Carengot described vermiform appendix in hernia sac[1] In 1756 Cheseldon successfully treated an incarcerated inguinal hernia for the first time[1]

In 1757 Pott described anatomy of hernia and strangulation[1 }] In 1785 Richter described a partial enterocele[1]

In 1790 John Hunter speculated the congenital nature of complete indirect inguinal hernias[1]

In 1793 De Gimbernat described the Lacunar ligament[1]

In 1804 Cooper described fascia transversalis and Cooper's ligament [1]

In 1811 Colle described the reflected part of the inguinal ligament (Colle's ligament)[1]

In 1816 Hasselbach described the Hasselbach triangle[1]

In 1816 Cloquet described the processus vaginalis, he also drscribed that processus vaginalis is rarely closed at birth[1]

In 1870 Listerintroduced the concept of aseptic surgery[1]

In 1871 Marcy described the Marcy's operation[1]

In 1874 Steele described a radical operation for inguinal hernia[1]

In 1875 Annandale described the extraperitoneal approach for the treatment of groin hernias[1]

In 1876 Czerny described the method of herniotomy by pulling the sac through the external ring and allowing it to retract[1]

In 1876 Lucas Chamoionniere opened the inguinal canal and reconstructed it by imbricating the anterior wall[1]

In 1881 MacEwan used the excess sac to plug the deep inguinal ring[1]

In 1887 Bassini published about his operation[1]

In 1889 Halsted described his method of inguinal hernia repair [1]

In 1890 Coley described his modification of Bassini's repair[1]

In 1891 Tait used midline incisions for the treatment of hernias[1]

In 1892 Wolfer described the relaxing incision to relieve the tension after hernia repair[1]

In 1893 Lockwood described the importance of fascia transversalis repair[1]

In 1895 Andrews described the method of double breasting of the layers[1]

In 1898 Brenner used the cremaster to strengthen the posterior wall of the inguinal canal[1]

In 1899Ferguson advised to leave the cord undisturbed during hernia repair[1]

In 1901 McArthur used a pedicled external obliqe aponeurosis for hernia repair[1]

In 1902 Berger used a rectus muscle flap for the repair of the hernias[1]

1n 1903 Halsted described a modification of his method. He avoided skeletionisation of the cord and used relaxing incision[1].

In 1906 Russel postulated the “saccular theory “ for the causation of inguinal hernias[1].

In 1907 Kocher described his method of hernia repair. He dissected, invaginated, and transpositioned the sac[1.]

1n 1909 McGavin used the silver filigree to repair the inguinal hernias[1].

In 1910 Krischner used fascia lata to repair the inguinal hernias[1].

In 1918 Handley used the darn/lattice technique for inguinal hernia repair[1].

In 1919 La Roque used transperitoneal grid iron incision for inguinal hernia repair[1].

In 1920 Cheatle used a midline extra peritoneal approach for inguinal hernia repair[1].

In 1921 Gallie used autologous fascia lata for inguinal hernia repairs[1].

In 1923 Keith speculated that tissue defect could be the reason for onset of inguinal hernias[1].

In 1927 Keynes used fascial graft techinques[1].

In 1942 Tanner popularized the relaxing incision[1].

In 1945 Mair used the buried skin for the repair of the inguinal hernias[1].

In 1952 Douglas studied the healing of aponeurosis and said that optimum strength was regained only after 120 days[1].

In 1953 Shouldice described his methods and published a case series[1].

In 1956 Fruchard introduced the concept of "myopectineal orifice''[1]

In 1958 Usher used a knitted polypropylene mesh for inguinal hernia repair[1].

In 1960 Anson and McVay described the musculo-aponeurotic layers[1].

In 1970 Lichenstein described the differences in healing in non-absorbable and delayed absorbable sutures[1].

In 1979 laparoscopic inguinal hernia repair was first attempted[1]

In 1981 Read described tissue defect , metastatic emphysema in smokers with inguinal hernia[1].

In 1981-83 Chan , Schurgers described the development of hernia in patients undergoing peritoneal dialysis[1].

In 1984 Gilbert described the umbrella plug for the repair of the inguinal hernias[1].

In 1985 Read postulated the role of smoking in the development of inguinal hernias[1].

In 1986 Lichenstein described tension free repair of inguinal; hernias[1].

In 1989 Gullmo described the role of herniography for the evaluation of obscure groin symptoms[1].

In 1990 Robbins and Rutkow introduced the concept of plug and patch repair[1].

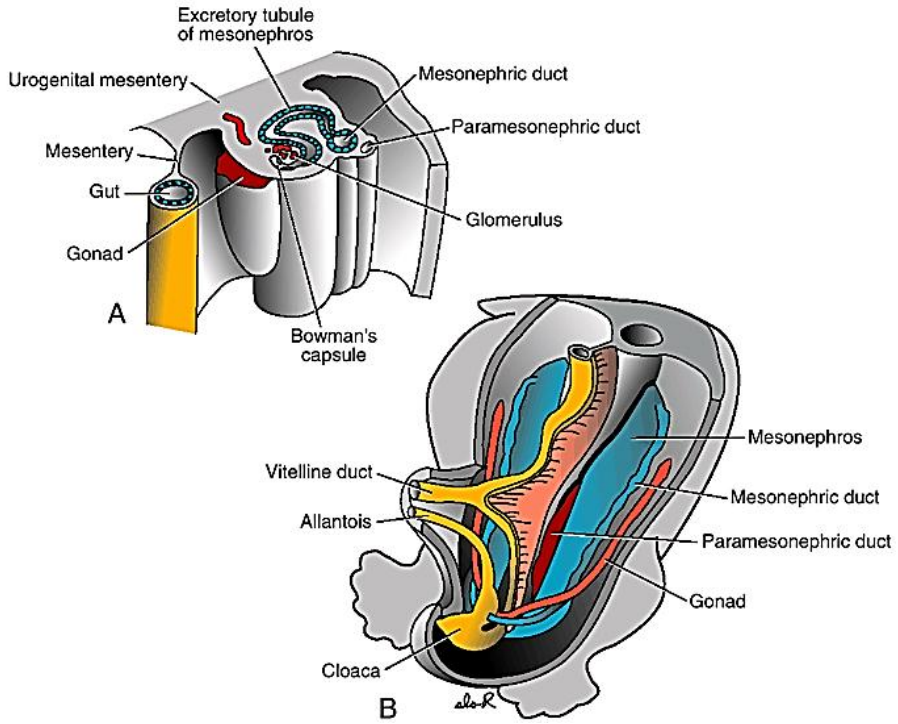
In 1990 Schultz first used synthetic biomaterial in laparoscopic inguinal hernia repair[1].

In 1992 Dulucq performed the laparoscopic extra peritoneal inguinal hernia repair[1].

In 1993 environmental factors in inguinal hernia causation is redefined[1].

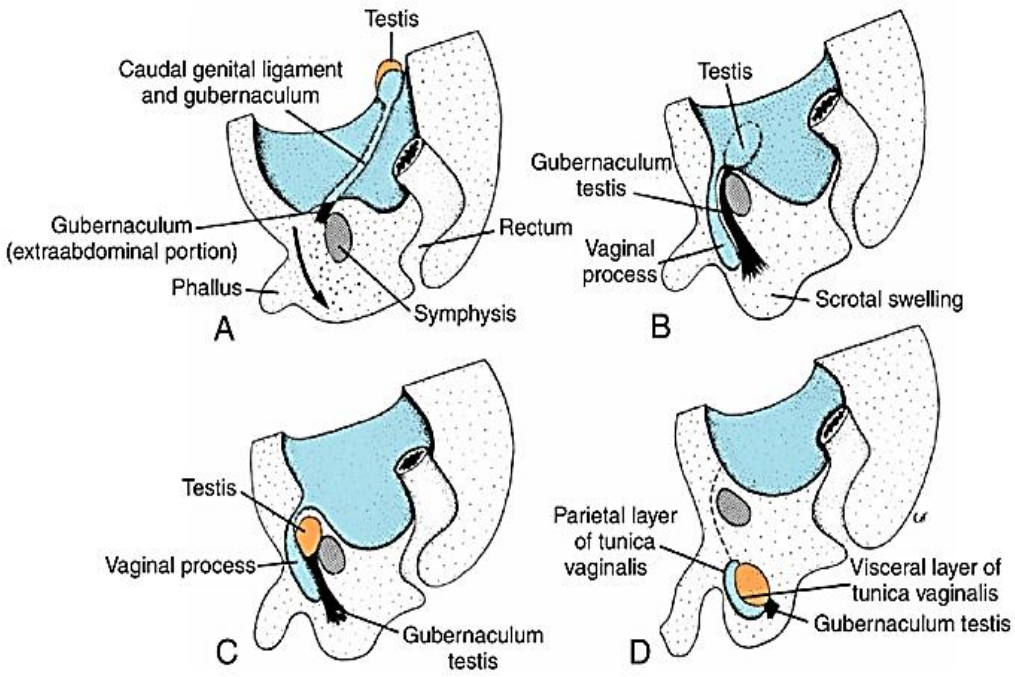
Embryology

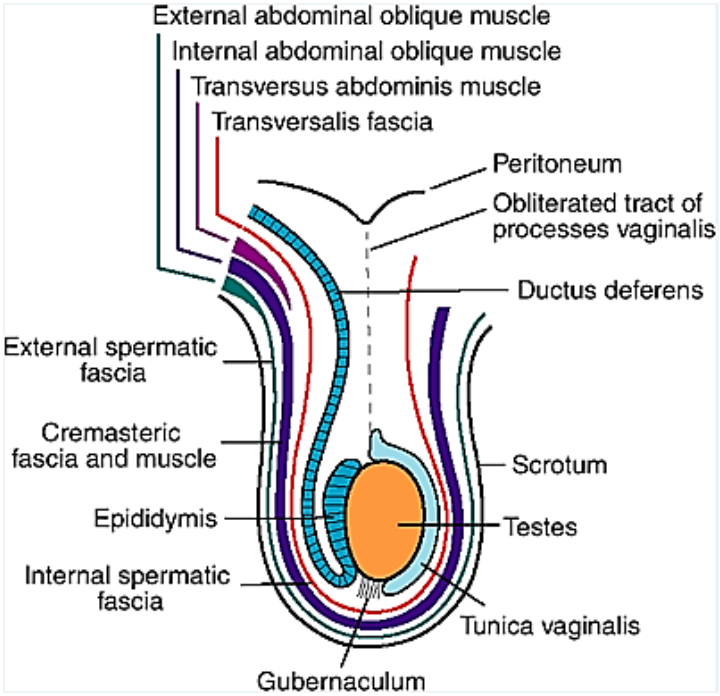
Descent of the testis:[3,11]



At the end second month of gestation , the urogenital mesentery attaches the testis and mesonephros to the posterior abdominal wall (A). The mesonephros degenerates and the urogenital mesentry now becomes the mesentery for the gonad (B). The gonadal mesentry becomes ligamentous and is known as the caudal genital ligament(gubernaculum) . It extends from the caudal pole of the testis to the inguinal region . It is rich in mesenchymal elements.During embryonic development , the differential growth of the abdominal muscles, the outgrowth of the extra-embryonic portion of the gubernaculum causes the intra-abdominal migration(12 weeks) and increase in intra-abdominal pressure due to organ growth causes the testis to pass through the inguinal canal(28

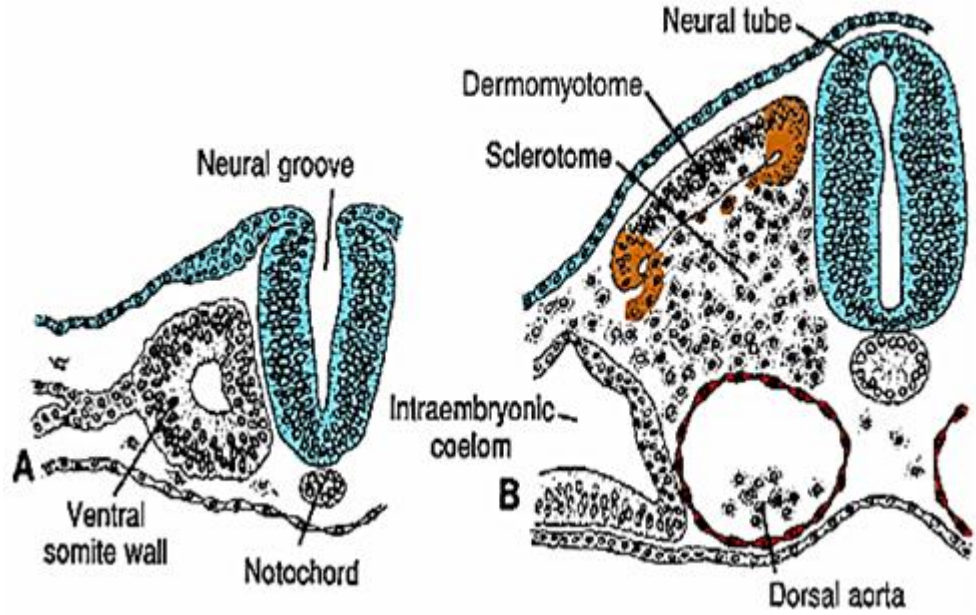
weeks), the regression of the extra-abdominal portion of the gubernaculum causes the testis to migrate into the scrotum(33 weeks). The gubernaculum is rudimentary in females.

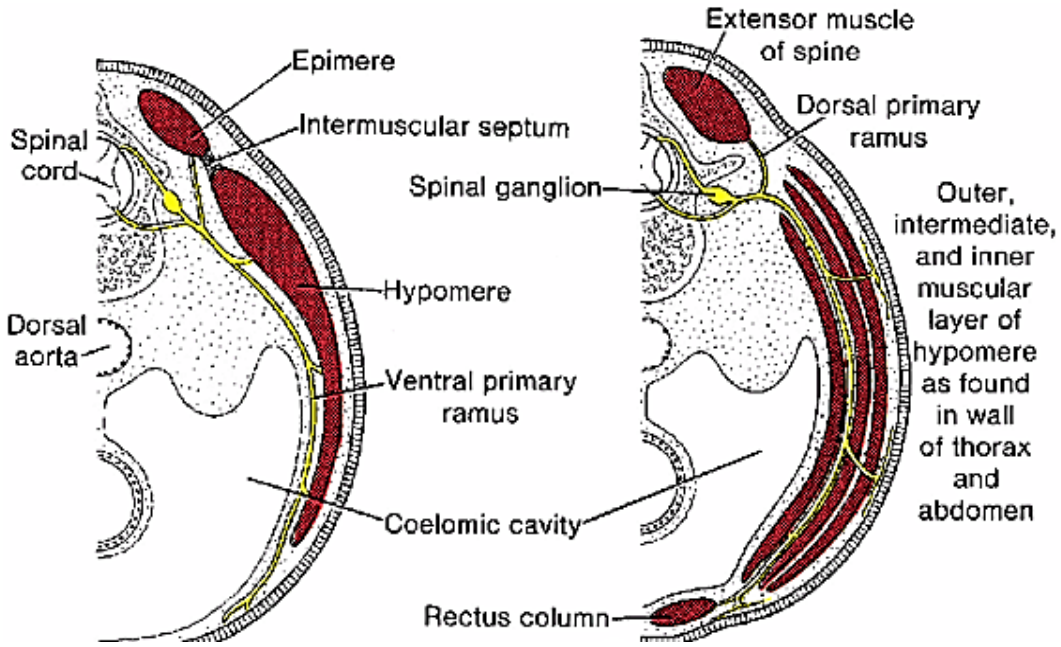




Independent from the testicular descent, the peritoneum of the abdominal cavity evaginates on either side of the midline into the ventral abdominal wall. This evagination called the Processus vaginalis, follows the course of the gubernaculum testis into the scrotal swellingsand carries all the fascial and muscular layers of the abdominal wall into the scrotumresulting in the formation of the inguinal canal. The opening produced in the transversalis fascia by the processus is the deep inguinal ring and that in the external oblique aponeurosis becomes the external or superficial inguinal ring. Between the rings is the inguinal canal.

Development of the abdominal wall[3,11]





Muscles of the anterior abdominal wall develop from the somites. The paraxial mesoderm differentiates into somite on either side of the vertebral column of the embryo . The somite slates differentiate into sclerotome, myotome, dermatome . The myotome inturn differentiates into dorsomedial epimere and the dorsolateral hypomere . The epimere gives rise to the muscles of the posterior abdominal wall and the hypomere gives rise to the muscles of the anterior abdominal wall.

During the sixth week of the fetal life the myoblasts in the hypomere differentiate and migrate laterally and medially and cover the somatopluerae and narrows the body stalk and the open midgut . At the 7^{th} week of gestation the medial end differentiate into two recti and the lateral parts become the anterolateral muscles of the abdominal wall.

ANATOMY OF INGUINAL CANAL

Inguinal canal is 4 cms long oblique tunnel lying above the medial half of the inguinal ligament through which the spermatic cord passes through to enter the scrotum . It extends from the deep inguinal ring to the superficial inguinal ring [1,11, 44].

It consists of superficial inguinal ring , deep inguinal ring , anterior wall , posterior wall floor and the roof.

Superficial inguinal ring[1,2,11]

It is a triangular defect in the external oblique aponeurosis. It is located 1 cm above and lateral to the pubic tubercle .Base of the triangle is formed by the pubic crest, apex is directed towards the anterior superior iliac spine, and the two sides are formed by the fibres of the external oblique aponeurosis known as medial and lateral crus . The spermatic cord in males and the round ligament in females exit through the superficial inguinal ring to enter the scrotum. It is variable in size and number.

Deep inguinal ring[1,2,11,44]

It is an oval shaped defect in the fascia transversalis . It is located 1.5 cms above the mid inguinal point. Base is formed by the iliopubic tract and the two limbs are formed by the thickened bands of fascia transversalis . these two bands play an important role in preventing hernia by shutter mechanism. The spermatic cord in males and the round ligament in females enter the inguinal canal through this deep ring .

Anterior wall[1,2,44]

The anterior wall of the inguinal canal is formed by external oblique aponeurosis , part of the anterior wall is formed by the conjoined tendon laterally .

Posterior wall[1]

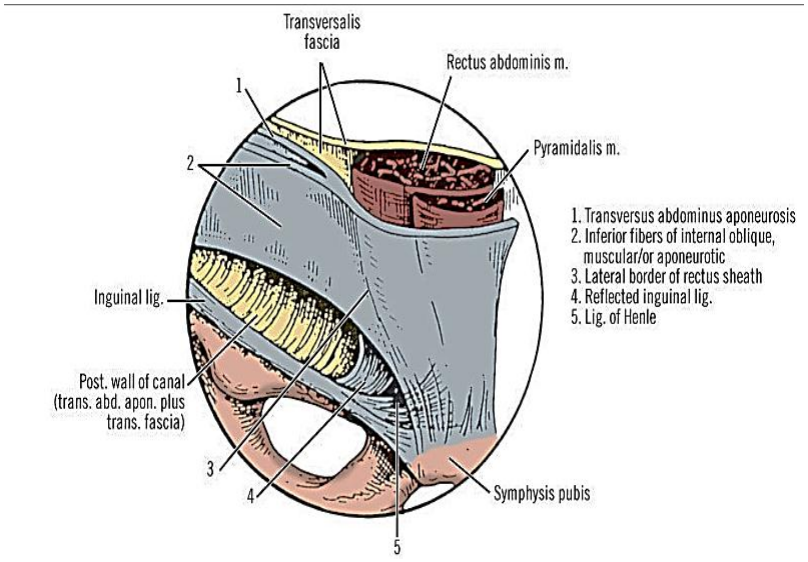
The posterior wall is formed by the fascia transversalis and peritoneum. In about 25% of the population medial portion of the posterior wall is formed by the conjoined tendon.

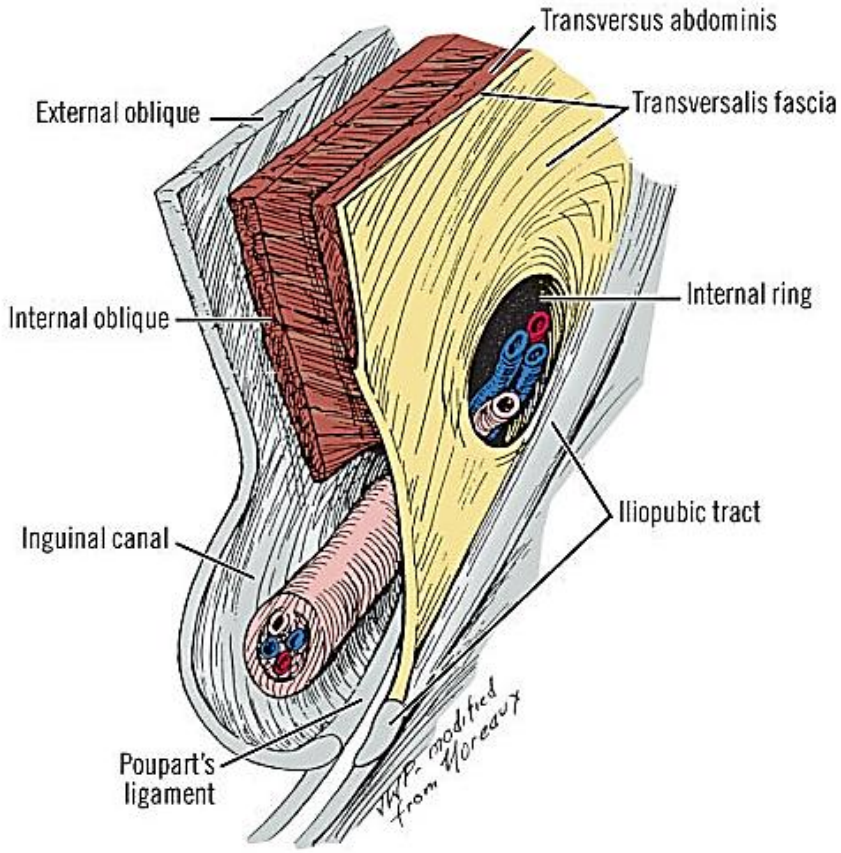
Superior wall [1,11,44]

Superior wall is formed by the arching fibres of the internal oblique and transversus abdominis muscles.

Inferior wall [1,44]

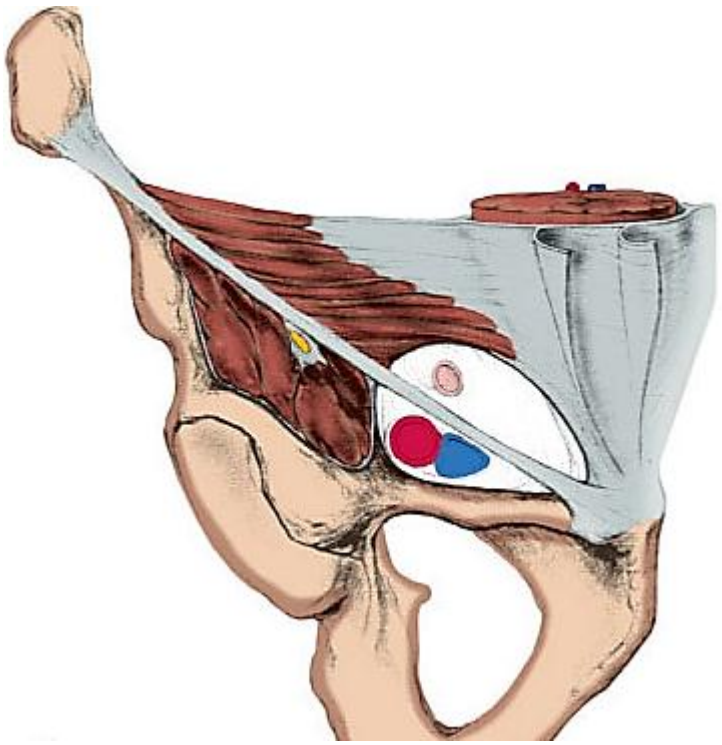
It is formed by the inguinal ligament and by the Lacunar ligament medially.





Myopectineal orifice of Fruchard[1,11,44,3]

Fruchard a French surgical anatomist during the second world war invented a new concept called the myopectineal orifice. Through this abdomino-crural orifice the femoral and inguinal hernias and the ilio-femoral vessels pass through . This revolutionary concept formed the basis for all the extra peritoneal repairs and the laparoscopic groin hernia repairs .It is also known as the piriform fossa .



The boundaries are [1,11]

Superior

Arch of internal oblique muscle and transversus abdominis muscle

Lateral

Iliopsoas muscle

Medial

Lateral border of rectus muscle and the anterior lamina of the rectus sheath

Inferior

Pectin pubis.

This myopectineal orifice is divided into two compartments by the inguinal ligament. The superior compartment through which the spermatic cord passes through and the inferior compartment through which the femoral vessels pass from the trunk to the lower limb.

Spermatic cord[1,11]

The spermatic cord is formed at the deep inguinal ring by the vas deferens and the gonadal vessels and by the layers of the abdominal wall . The spermatic cord enters the inguinal canal at the deep inguinal ring and traversus through the inguinal canal and exits through the superficial ring.

Coverings of cord [1,3,8]

Inguinal part of the cord is covered by the cremaster and the internal spermatic fascia which is derived from the transversalis fascia . From the external inguinal ring downwards the cord is covered additionally by the external spermatic fascia derived from the external oblique aponeurosis.

Contents [1,11, 8, 3]

Three fascia

1) External spermatic fascia
2) Cremasteric fascia
3) Internal spermatic fascia

Three arteries

1) Cremasteric artery

2) Testicular artery

3) Artery to the vas

Three veins

1) Pampiniform plexus

2) Cremasteric vein

3) Vein of vas

Three nerves

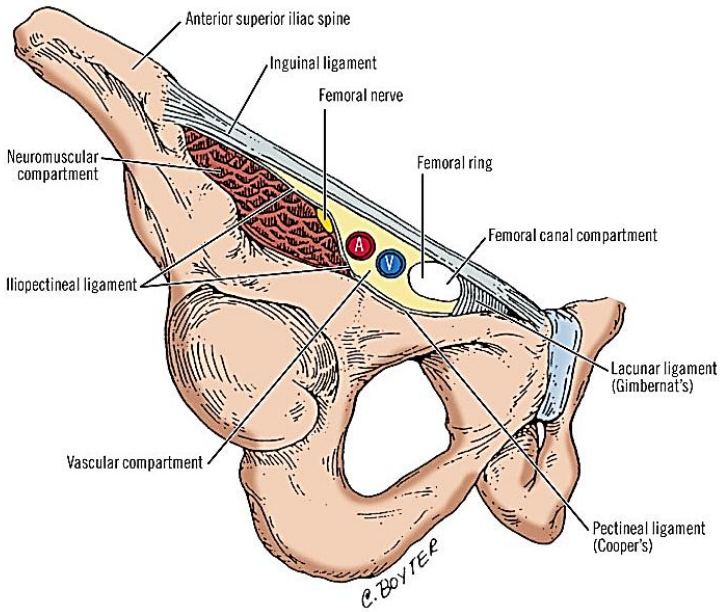
1) Ilio-inguinal nerve

2) Genital branch of genito-femoral nerve

3) Sympathetic nerves

Lymphatics

INGUINAL LIGAMENT[1,11,8]



The lower border of the external oblique aponeurosis becomes inrolled and forms the inguinal ligament . It extends from the anterior superior iliac spine and the pubic tubercle .

The medial part of the inguinal ligament is straight and the lateral part is curved. The medial part forms a gutter for the passage of the spermatic cord.

Gimbernat's Ligament[1,11,3]

At the medial end of the inguinal ligament some fibres of the external oblique aponeurosis expand and form a triangle shaped structure and gets attached to the pubic tubercle . It also known as the Lacunar Ligament.

Colle's Ligament[1,11]

Some fibres of the inguinal ligament pass upwards and medially behind the superficial inguinal ring and gets attached to the rectus sheath and the linea alba to form the reflected part of the inguinal ligament. It closes the potential space between iliopectineal line and the lateral border of rectus sheath in the posterior wall of the inguinal canal.

Cooper's Ligament[1,11]

It is also called the pectineal ligament .It is a fan like expansion at the medial end which curves posteriorly to the iliopectineal ligament .It is an lateral extension of the lacunar ligament.

Iliopubic Tract [1,11]

It is an aponeurotic band at the lower border of the transversalis fascia . It extends from the anterior superior iliac spine laterally to the Cooper's ligament medially . It forms the lower border of the deep inguinal ring . It also forms the anterior and medial wall of the femoral sheath .Inferiorly it is attached to the inguinal ligament .

Iliopectineal Arch[1,11]

It is the band of fibres dividing the space beneath the inguinal ligament lateral muscular and medial vascular compartments . Laterally it is attached to the anterior superior iliac spine , medially to the pectineal eminence .

Hasselbach's Triangle[1]

It lies in the posterior wall of the inguinal canal. It is bounded by lateral border of rectus abdominis laterally, inguinal ligament inferiorly, medially by the inferior epigastric artery.

FOSSAS IN THE INGUINAL REGION[11]

Lateral inguinal fossa

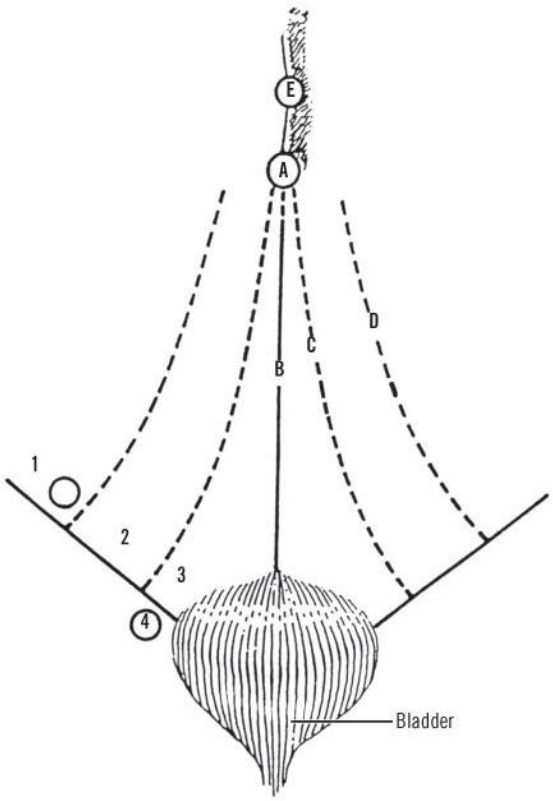
It lies lateral to the deep inferior epigastric vessels

Medial inguinal fossa

It lies between the inferior epigastric artery and the medial umblical ligament.

Supravesical fossa

It lies between the medial umblical ligament and the median umblical ligaments .



A, Umbilicus. **B,** Median umbilical ligament (obliterated urachus). **C,** Medial umbilical ligament (obliterated umbilical arteries). **D,** Lateral umbilical ligament containing inferior (deep) epigastric arteries. **E,** Falciform ligament.

MUSCLES OF THE ANTERIOR ABDOMINAL WALL

External oblique[1,11,2,3]

It is the outmost layer of the muscular wall of the abdomen.

Origin

It arises from the Outer surface of lower 8 ribs. Upper four slips interdigitate with the serratus anterior and lower four slips interdigitate with the lattismus dorsi.

Insertion

Superior and Middle fibres form an aponeurosis and get attached to the Linea Alba.

Lower fibers descend vertically and attach to the outer lip of the Iliac Crest

The lower margin of the aponeurosis form the Inguinal ligament

Blood Supply

Lower posterior intercostal and subcostal arteries

Superior and Interior Epigastric arteries.

Superficial deep circumflex iliac arteries

Posterior lumbar arteries.

Nerve Supply

Terminal branches of lower five intercostal nerves

Subcostal nerves

Action

Maintains abdominal tone
Increases intra abdominal pressure
Lateral flexion of the trunk against resistance

Internal Oblique[1,2,3,11]

This is the second layer of the abdominal wall muscles.

Origin and Insertion

Upper fibres arise from the anterior two –thirds of the middle part of the iliac crest. It runs upwards and medially and gets inserted to inferior border of lower four ribs.

Intermediate fibres arise from the lumbo-dorsal fascia. It runs horizontally and gets attached to the inferior border of 7^{th} and 8^{th} ribs, xiphoid process and line alba by a strong aponeurosis.

Lower fibres arise from the lateral part of the inguinal ligament and arch over the spermatic cord / round ligament to join the lower fibres of transversus abdominis muscle to form conjoint tendon and gets inserted to the pubic crest and iliopectineal line.

Blood Supply

Lower posterior intercostal and subcostal arteries

Superior and Interior Epigastric arteries.

Superficial deep circumflex iliac arteries

Posterior lumbar arteries.

Nerve Supply

Terminal branches of lower five intercostal nerves

Subcostal nerves

Iliohypo gastric and ilioinguinal nerves .

Action

Maintains abdominal tone

Increases intra abdominal pressure

Lateral flexion of the trunk against resistance

Cremaster [1,2,11]

It is an striated involuntary muscles. It consists of loosely arranged muscle fibres of variable thickness covering the spermatic cord and testis incompletely. It arises from the infero –medial border of the internal oblique and transverses abdominis , middle part of the inguinal ligament, the pubic tubercle and lateral part of the pubic crest. It is inserted to the coverings of the cord and testis .

Blood Supply

Cremasteric artery , a branch of the inferior epigastric artery.

Nerve Supply

Genital branch of genitofemoral nerve (L1,L2).

Action

It plays an important role in thermoregulation of the testis .

Transversus Abdominis [1,11,2]

This is the innermost muscle of the anterior abdominal wall .

Origin and Insertion

Upper fibres arise from the inner aspect of the lower six costal cartilages along with the diaphragm and gets attached to the linea alba by means of a strong aponeurosis.

Middle fibres arise from the thoraco-lumbar fascia , anterior two-thirds of the inner lip of the iliac crest and run transversely to get attached to the linea alba by a strong aponeurosis.

Lower fibres arise from the lateral part of the inguinal ligament and the associated iliacus fascia . They run downwards and medially to get inserted to the pubic crest and the iliopectineal line . It takes part in the formation of conjoint tendon along with lower fibres of the internal oblique muscle .

Blood Supply

Lower posterior intercostal and subcostal arteries

Superior and Interior Epigastric arteries.

Superficial deep circumflex iliac arteries

Posterior lumbar arteries.

Nerve Supply

Terminal branches of lower five intercostal nerves

Subcostal nerves

Iliohypo gastric and ilioinguinal nerves

Action

Maintains abdominal tone

Increases intra abdominal pressure

Interfoveolar Ligament[1,3,11]

A band of fibres which may be muscular arising from the lower border of the transversus abdominis near its insertion and getting attached to the inguinal ligament is known as the interfoveolar ligament .

Conjoint Tendon[1,3,11]

The fused aponeurosis of the internal oblique and the transversus abdominis which gets attached to the pubic crest and the iliopectineal line is known as the “conjoint tendon” or the “conjoined area”.

80% is formed by the transversus abdominis and 20% by the internal oblique muscle . It lies deep to the superficial inguinal ring and lateral to the rectus abdominis . It is absent in 20% of population.

Falx Inguinalis [1,3,11]

The lowermost fibres of the transversus abdominis aponeurosis is turns inferiorly and gets attached to the pubis . It is known as the Falx inguinalis

Henle’s Ligament[1,3,11]

Few fibres of the lower part of the rectus sheath gets attached to the inguinal ligament to form the Henle’s ligament.

Rectus Abdominis[1,11,3,8]

It is a midline paired muscle of the anterior abdominal wall It lies on the either side of the linea alba .It extends from the xiphoid process to the pubic symphysis . It has three tendinious intersections , one at the xiphoid process , one at the umblicus and the third one between the other two. There may be additional intersections below the umbilicus.

Origin

It arises by two tendons , larger lateral tendon arise from the pubic crest , pubic tubercle, pectineal line . The smallermedial tendon arise from the pubic symphysis and from the contralateral muscle . Some fibres arise from the linea alba.

Insertion

It divides into three slips and gets inserted into xiphoid process and 5,6,7 ribs.

Blood Supply

Superior and inferior epigastric arteries

Lower three intercostal arteries

Subcostal arteries

Posterior lumbar arteries

Deep circumflex iliac arteries

Nerve Supply

Lower six intercostal nerves

Subcostal nerves

Actions

Flexion of the trunk

Maintenance of the abdominal wall tone during straining

Linea Alba[1,3,11]

It is a fibrous band formed by the decussating of the aponeurosis of the muscles of the anterior abdominal wall . It extends from the xiphoid process to the pubic symphysis . It is broad above the umbilicus and narrow below the umbilicus and broadest at the umbilicus . It is pierced by several vessels including the umblical vessels in the fetus .

Rectus Sheath[1,3,11]

It is a fibrous sheath enclosing the two rectus abdominis muscles . It has two layers . Anterior complete layer covering entire length of the rectus muscle from the xiphoid process to the pubic symphysis . The posterior layer is incomplete it ends midway between the umbilicus and the pubic symphysis at the arcuate line of Douglas.

The antero-lateral muscles of the abdominal wall end in a bilaminar aponeurosis which forms the rectus sheath.

The anterior layer is formed by the both the lamina of the external oblique aponeurosis and the anterior lamina of the internal oblique aponeurosis .

The posterior lamina is formed by both the lamina of the transversus abdominis and the posterior lamina of the internal oblique aponeurosis.

Pyramidalis [1,3]

It is a triangular muscle lying within the rectus sheath at the lower part of the rectus abdominis muscle . It arises from the pubis and the ligaments of the pubic symphysis and gets inserted into the linea alba midway between the umbilicus and the pubic symphysis. It may be absent in 10% of the population. It is unilateral in some people . It is supplied by the subcostal nerve. Its function is tensing the linea alba .

Fascia Transversalis [1]

It lies deep to the abdominal musculature, it also forms the posterior wall of the inguinal canal. It is thin in the upper abdomen and thick in the lower abdomen. In the inguinal region it has two layers the anterior thick layer attached to the inner aspect of the transversus abdominis and the inguinal ligament . The posterior layer lies between the anterior layer and the peritoneum. It is membranous and gets attached to the pectineal ligament and continues into to the pelvis as the pelvic fascia.

The space between the two layers is known as the "space of Bogros'' which contains the inferior epigastric vessels .

MECHANISMS THAT PREVENT INGUINAL HERNIA FORMATION

Shutter Mechanism: [1]

The fascia transversalis is thickened at the medial and the lateral part of the deep inguinal ring , with the base formed by the iliopectineal ligament . This forms a " U" shaped sling around the deep inguinal ring , through which the cord is suspended .During coughing or straining the transversus abdominis muscle contracts which pulls the sling super-laterally and thereby increasing the obliquity of the deep ring at the exit of the spermatic cord . this prevents the formation of the indirect inguinal hernias.

Valve Mechanism[1]

The internal oblique and the transversus abdominis muscles lying anterior to the deep ring presses against it when the intra-abdominal pressure increases, thus preventing the formation of hernias .

Etiology of Inguinal Hernias [1,4,6,7,9.10]

Inguinal hernias contribute to 94% of all hernias . It is more common in males . the ratio varies from 8:1 to 20: 1. 65% of the inguinal hernias are indirect hernias, and right side hernias are more common than the left sided hernias . Bilateral inguinal hernias are commonly direct

inguinal hernias. The prevalence of the inguinal hernias varies widely between countries and different age groups . The prevalence increases with increasing age.

Congenital Theory[1]

It is based on the fact that the coverings of the adult complete inguinal hernia is same as that of the coverings of the inguinal hernia in a neonate . It is supported by the fact that 15-30 % of the adult population had patent processus vaginalis without any herniation .

Saccular Theory[1]

Russel postulates that mere presence of patent processus vaginalis is not sufficient for the development of the hernias. There should be an associated connective tissue disorder of the abdominal wall for the development of the hernias. This is supported by the fact that treatment of the adult inguinal hernia by herniotomy alone results in high rate of recurrence .

Genetic[1]

Inguinal hernias are inherited in some families. The inheritance may be

Autosomal dominant with incomplete penetrance

Autosomal dominant with sex influence

X-linked dominant

Polygenic

Anatomical Predispositions[1]

Height of the pubic arch: It is defined as the length of the perpendicular line drawn from the pubic tubercle to the line drawn between the two anterior superior iliac spines.

Shorter the arch higher the incidence of hernias . Short arch leads to narrow origin of the external oblique muscle and failure of the shutter mechanism.

Congenital Defects [1]

Presence of congenital defects in the abdominal musculature predisposes to the formation of hernias. A congenital defect between the conjoint tendon and the pyramidalis muscle has been known to cause inguinal hernias.

Connective Tissue Disorders[1]

Alteration in the nature of collagen , like chance in the ratio of type 1 :type 3 collagen has been noted in fascia transversalis of patients with inguinal hernias. Decrease in hydroxyprolene in the rectus sheath and reduced ratio of hydroxyproline: proline in transversalis fascia predisposes to hernia .

Intra Abdominal Causes[1]

Ascities due to any causes increased hydrostatic pressure inside the peritoneum, which in turn enlarges the opening of the processus vaginalis and subsequent herniation of abdominal contents.

Peritonitis due to any causes can cause inguinal hernia by increasing the intra abdominal pressure .

CAPD-continuous ambulatory peritoneal dialysis is also known to cause inguinal hernia.

Appendicectomy[1]

Cosmetic incision used for appendicectomy has increased risk of iliohypogastric nerve injury and subsequent denervation and weakening of the transversus abdominis predisposes to the formation of hernia. No definitive evidence is available to support this hypothesis. McBurney's incision used for appendicectomy rarely causes iliohypogastric nerve injury.

Trauma[1]

Blunt trauma to the lower abdomen or the pelvic skeleton can cause inguinal hernia. Post traumatic disruption of the tissues in the inguinal region resulting in inguinal hernia has been reported . Blunt trauma to the pelvic skeleton causes disruption of the tendinious attachment of the abdominal musculature causing hernia.

Iatrogenic

During osteotomy for congenital dislocation of hip correction ,the angle between the midline and the superior pubic rami increases which predisposes to the formation of hernias.

Chronic Cough[1,6,7,3,]

Chronic cough as a cause of inguinal hernia is only of historic value .

Exertion[1,7,8]

There is no evidence to support that exertion or sternous exercise alone as a cause of inguinal hernia. There should be an underlying connective tissue disorder for these patients to develop.

Environmental Factors[1,3,5,6]

Recent research suggests the role of environmental factors in the expression of the inherited hernia genes also in the manifestation of connective tissue disorder in people doing sternous works .

CLASSIFICATION OF INGUINAL HERNIAS: [1,7,44]

There are several classifications for inguinal hernias

Classification I(clinical)[1,44]

1) Reducible hernia
2) Irreducible hernia
3) Obstructed hernia
4) Inflamed hernia
5) Strangulated hernia

Classification II[1,44]

1) Congenital hernia
2) Acquired hernia

Classification III (according to the contents)[1,44]

1) Omentocele - omentum
2) Enterocele - intestine
3) Cystocele - urinary bladder
4) Littre's hernia - meckel diverticulum

Classification IV (anatomical)[1]

1) Indirect hernia
2) Direct hernia

Classification V (according to the extent)[1]

1) Bubonocele

2) Funicular

3) Complete

Classification VI (newer classification)[1]

1) <u>Gilbert classification</u>[1]

Type 1 indirect, tight internal ring

Type 2 indirect, deep ring < 4 cm

Type 3 indirect, patulous deep ring > 4 cm (sliding / scrotal hernias)

Type 4 direct, defective posterior inguinal wall

Type 5 direct, supra pubic defect

Type 6 direct & indirect

Type 7 femoral hernias

2) Nyhus classification[1]

Type	Direct / indirect	Internal ring	Hasselbach's triangle	Sac
Type 1	indirect	Normal size, structure & configuration	normal	Within the canal
Type 2	indirect	Enlarged , distorted	normal	Within the canal
Type 3 3A 3B 3C	 Direct Indirect Femoral	 ---------- Dilated ----------	 Weak ---------- ----------	 ---------- Into scrotum ----------
Type 4 4A 4B 4C 4D	Recurrent Direct Indirect Femoral Combined			

3) Bendavid's classification[1]

Based on Type Stage Dimension

5 TYPES

Type 1(anterolateral / indirect)

Stage 1 deep ring to superficial ring

Stage-2 between superficial ring and scrotum

Stage-3 reaches into scrotum

Type 2 (anteromedial / direct)

Stage 1 deep ring to superficial ring

Stage 2 between superficial ring and scrotum

Stage 3 reaches into scrotum

Type 3 (posteromedial / femoral)

Stage 1 occupies a portion of distance between femoral vein and lacunar ligament

Stage 2 goes the entire distance between femoral vein and lacunar ligament

Stage 3 extends from femoral vein to the pubic tubercle (recurrences, destruction of lacunar ligament)

Type 4 (posterolateral / prevascular)

Stage 1 medial to femoral vein (Cloquet, Laugier)

Stage 2 located at the level of the femoral vessels (Velpeau , Serafini)

Stage 3 lateral to the femoral vessels (Hasselbach , Partridge)

Type 5 (anteroposterior / inguino-femoral)

Stage 1 has lifted or destroyed a portion of the inguinal ligament between pubic crest and femoral vein

Stage 2 has lifted or destroyed the inguinal ligament between pubic crest and femoral vein

Stage 3 has destroyed the inguinal ligament from pubic tubercle to a point beyond the femoral vein

COMPLICATIONS

Pre-operative complications [1]

1) Rupture of the hernia [1]

It can be either spontaneous or traumatic leading to evisceration of the contents.

2) Involvement of the hernia sac in the disease processes

a. mesothelial hyperplasia

b. carcinomatosis

c. endometriosis

d. leiomyomatosis

e. inflammation (appendicitis is most common)

3) Incaraeration[1,3,22]

Incarceration is a state of an inguinal hernia which cannot be reduced into the abdomen. These hernias are at an increased risk of strangulation or obstruction .These hernias should be operated at the earliest .Incarceration may be due to 1)narrow neck 2)adhesions between the sac and the contents .3)pathological viscous as contents of hernia 4)impacted faces inside the incarcerated large bowel. Forceful reduction may lead to reduction –en-masse [1,3, 22,36]

4) Obstruction

Compression of the bowel contained inside the hernia sac leads to intestinal obstruction . It is an surgical emergency. The obstruction may be at the level of the deep ring or superficial ring or due to stricture or a tumor in the contained bowel.

5) Strangulation

It is a life threatening complication of inguinal hernia. The incarcerated bowel loses its blood supply and becomes gangrenous causing significant morbidity and mortality. Initial obstruction leads to obstruction of lymphatic's and venous return, which causes congestion , increased capillary permeability and ultimately loss of blood supply and gangrene.

6) Reduction –en-masse[1,22]

It refers to reduction of the external hernia with continued incarceration or strangulation of the internally prolapsed hernia contents. It is usually due to the forceful reduction of an incarcerated hernia .

Three types are noted

a. reduction along with neck and the sac, it occurs when an fibroses ring is surrounded by weak tissues

b. reduction along with neck without the sac. It is the most common type.

c. reduction of the contents without the sac and neck into another preperitoneal sac.

Post operative complications[1]

Intra-op complications: [1,36,28]

1) injury to the vas deferens

2) injury to the blood vessels

pampiniform plexus, cremasteric artery, testicular artery, femoral / iliac vessels can be injured

3) injury to nerves

ilio inguinal nerve , ilio hypogastric nerve , genital branch of the genitofemoral nerve can be injured

4) injury to bowel

5) injury to urinary bladder

Post operative complications[1]

1) Hematoma

   It may be either superficial or deep, it is commonly associated with intra operative vessel injury

2) Urinary retention

   It can be either due to anaesthetic complication or due to patient factors like prostatic enlargement or prolonged surgery

3) Seroma

   It is the serous effusion of the wound .It commonly presents with painless fluctuant swelling in the post-operative period . It may be either due to a tissue reaction to the mesh, or due to fat lysis due to excessive tissue handling or excessive use of diathermy

4) Funiculitis

   painful swelling of the cord in patients who needed skeletonisation of the cord

5) Orchitis

   It occurs due to vascular damage during dissection of the cord. Venous damage is more common than the arterial damage .

6) Infection

   It can be superficial wound infection , infection of the hematoma or seroma, or the infection from with in due to wound contamination by bowel contents .

7) Chronic groin pain[17,26]

It is defined as significant pain persisting for more than three months after surgery requiring intervention . It may be due to periosteitis, mesh related , and non-mesh related causes like nerve entrapment , rolling up of the mesh . It can be prevented by using a light weight mesh and applying minimal stitches for mesh fixation . Resistant cases require triple nerve resection.

8) Sensory disturbance[36]

Due to intra operative nerve injury or nerve entrapment

9) Testicular atrophy

10) Hydrocele

11) Recurrence

Family history, Connective tissue disorder, Smoking , Benign Prostratic hypertrophy, are the predisposing causes

12) Infertility and sexual dysfunction

Due to vas injury or narrowing of the vas due to mesh reaction.

MATERIALS AND METHODS

In our institution about 300 to 400 cases of inguinal hernia repairs are performed each year . anterior open method of inguinal hernia repair, commonly Lichenstein's tension free mesh repair is performed, less commonly modified Bassini's repair is done for complicated inguinal hernias with wound contamination.

200 patients diagnosed to have an inguinal hernia are included in this study irrespective of type of inguinal hernia like direct inguinal hernia, indirect inguinal hernia, recurrent inguinal hernia, bilateral inguinal hernia, pantaloon hernia, and complicated hernias like incarcerated inguinal hernias, obstructed inguinal hernias and strangulated inguinal hernias are included in the study.

Inguinal hernias due to ascities , peritoneal dialysis, connective tissue disorders , inguinal hernias in children less than 12 years, inguinal hernias in pregnant and lactating women, and patients not willing to participate in this study are excluded from this study.

All the participants in this study are thoroughly explained about this study and an informed written consent is obtained from the patient or from their parents or guardians .

Age, sex, body mass index(BMI), and history regarding nature of occupation, smoking or tobacco use, alcohol use, and associated co-morbidities like diabetes mellitus(DM), coronary artery heart disease (CAD), systemic hypertension(SHT), chronic obstructive pulmonary

disease (COPD), Benign Prostratic Hypertrophy (BPH), constipation are recorded. Complete hemogram, electro cardiogram (ECG), chest xray (CXR), abdomen xray(AXR) ultrasonogram(USG) of the groin and abdomen are done.

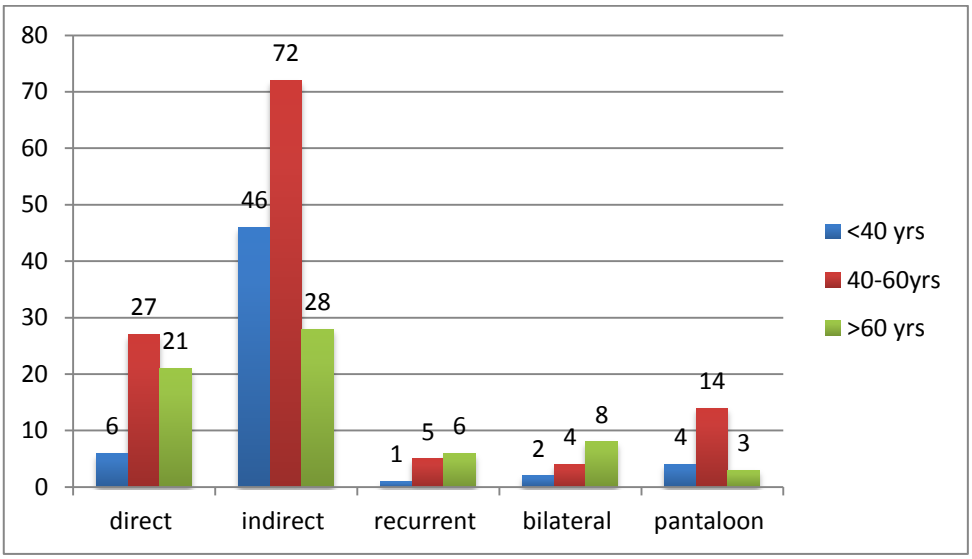
Patients presenting with pre-operative complications like incarceration, strangulation or obstruction are put in one group, their associated hernia is repaired using modified Bassini's method, the type of hernia , associated factors like smoking, tobacco use, alcoholism, and co-morbid illness like are studied and the data obtained are analysed.

Patients with uncomplicated inguinal hernias are stratified according to age , duration of illness BMI , associated symptoms and co-morbid illness .all the patients are operated using the same anaesthetic technique (spinal anaesthesia), Lichenstein's tension free mesh repair technique is done using the same kind of mesh for all the patients (polypropylene mesh: ETHICON) and same type of suture materials are used for all the patients for the purpose of standardization . Post-operative complications including the intra-operative complications are divided into two categories, complication before three months and complications persisting or occurring three months .Patients included in this study are asked to follow up regularly in out patient department on second week, second month , one year and at the end of two years and are examined for the complications .The identified complications are treated accordingly . The data collected are analysed statistically.

OBSERVATION AND RESULTS

CHART - 1

Age Distribution of Different Types of Hernias



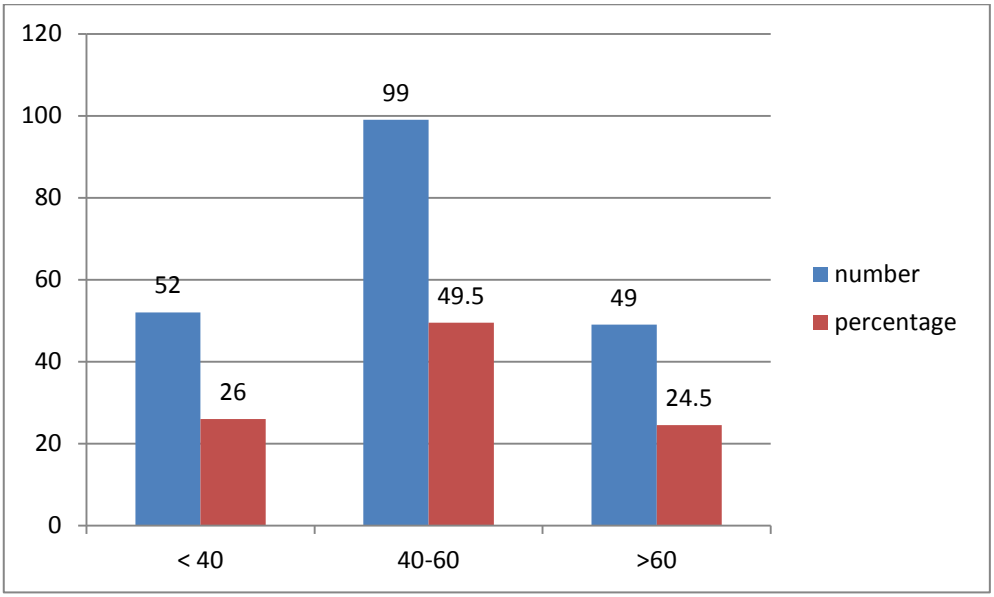
In our study patients with inguinal hernias are grouped into three categories based on the age group. In patients belonging to the < 40 years group 6 patients had direct inguinal hernia, 46 patients had indirect inguinal hernias , 1 patient had recurrent inguinal hernia , 2 patients had bilateral inguinal hernias ,4 patients had pantaloon hernia.

In patients belonging to the age group of 40 to 60 years, 27 patients had direct inguinal hernia, 72 patients had indirect inguinal hernia , 5 patients had recurrent inguinal hernia, 4 patients had bilateral inguinal hernia, and 14 patients had pantaloons hernia.

In patients belonging to the group > 60 years , 21 patients had direct inguinal hernia 28 patients had indirect inguinal hernias ,6patients had recurrent inguinal hernias,8 patients had bilateral hernias ,3 patients had pantaloons hernia.

CHART - 2

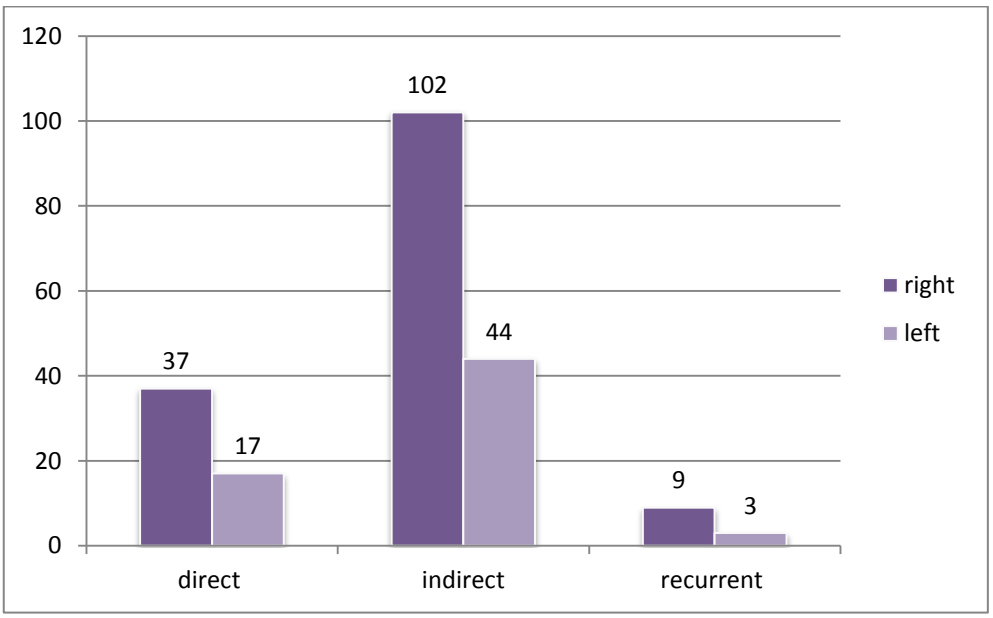
No. of Hernias Agewise



In our study a total of 200 inguinal hernia patients were included. 52 patients (26%) were in the age group of less than 40 years. 99 patients (49.5%) were in the age group of 40 to 60 years. 49 patients (24.5%) of the patients were in the age group of more than 60 years.

CHART - 3

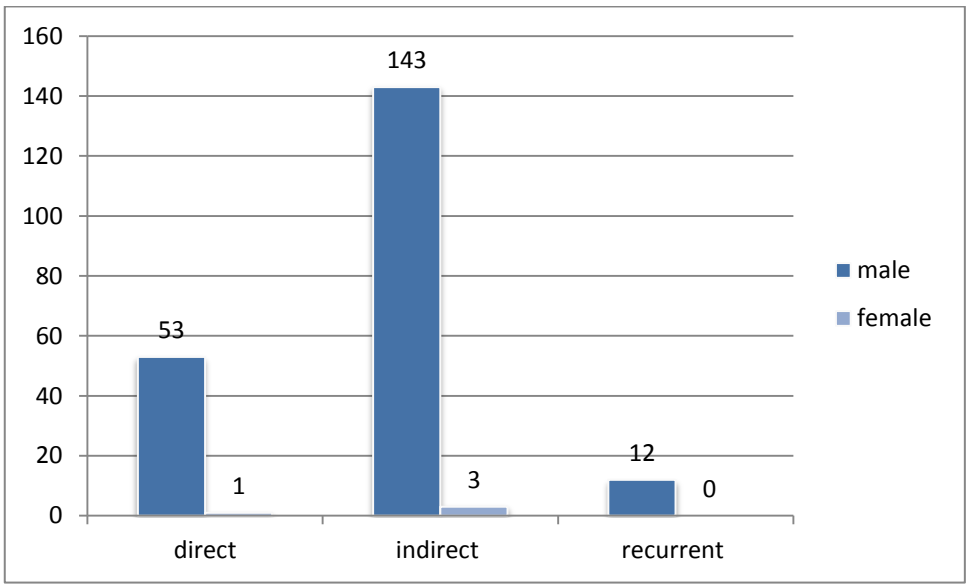
Types of Hernias



In our study 54(27%) patients had direct inguinal hernia, 146(68%) patients had indirect inguinal hernia. 12(6%) patients had recurrent inguinal hernia. 139(69.5%) patients had right inguinal hernia and 61(30.5%) patients had left inguinal hernias , 16(8%) patients had bilateral inguinal hernia.

CHART - 4

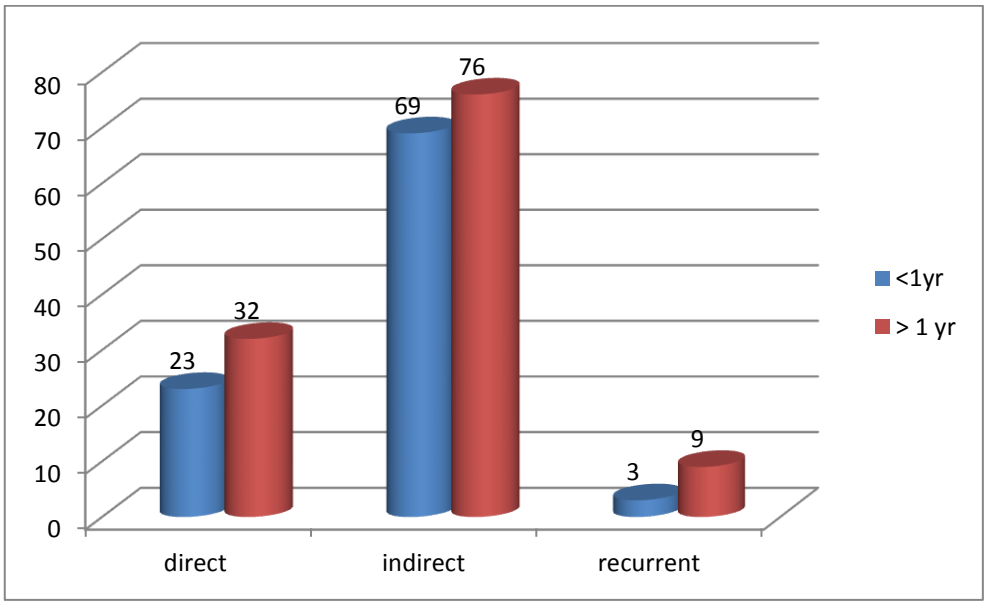
Sex Distribution of Hernias



In our study out of 200 patients 196(98%) patients were males and 4(2%) patients were females . out of the 4 female patients 1(25%) patient had direct inguinal hernia and 3(75%) patients had indirect inguinal hernias , all the female patients had right inguinal hernia(100%).

CHART - 5

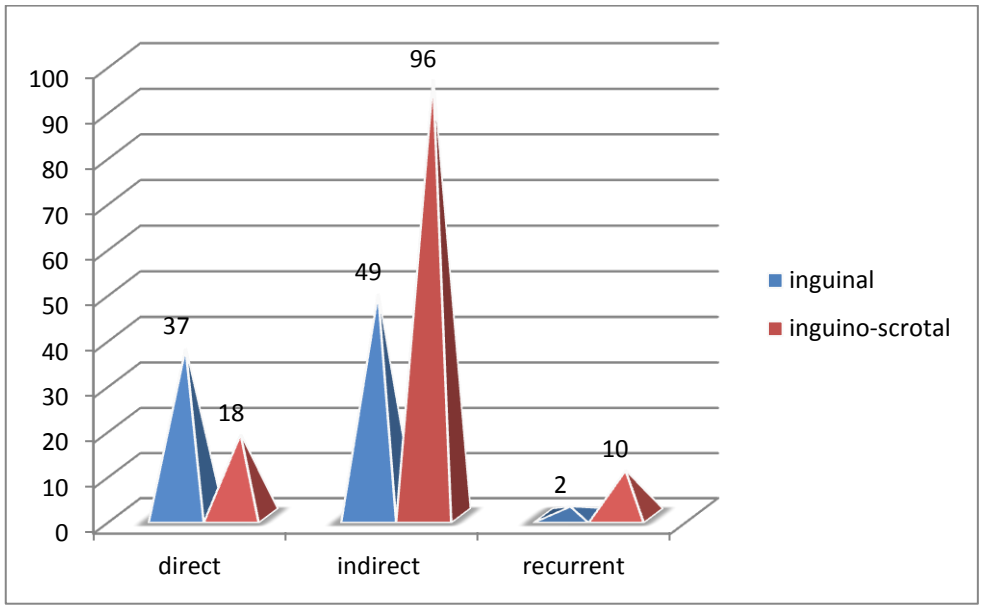
Duration of Hernias



In our study 92 (46%) out of 200 patients presented with symptoms for less than one year , 108 patients (54%)had symptoms for more than one year

CHART - 6

Type of Hernia



In our study. 86 patients (43%) had inguinal swelling. 117 patients (58.5%) had inguino scrotal swelling . 67%% (37)of the patientswith direct hernia had inguinal swelling and 33 %(18) of the patients with direct hernia had inguino scrotal swelling. 34%(49) of the patients with indirect hernias has inguinal swelling. 66% (96) of the patients with indirect inguinal hernias has inguino scrotal hernias.

CHART - 7

Types of Hernia (Percentage)

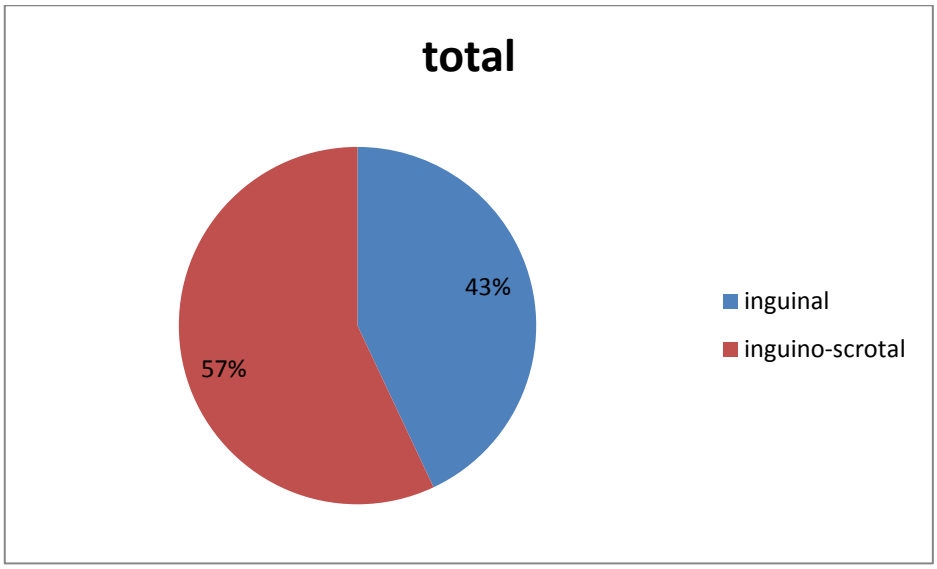
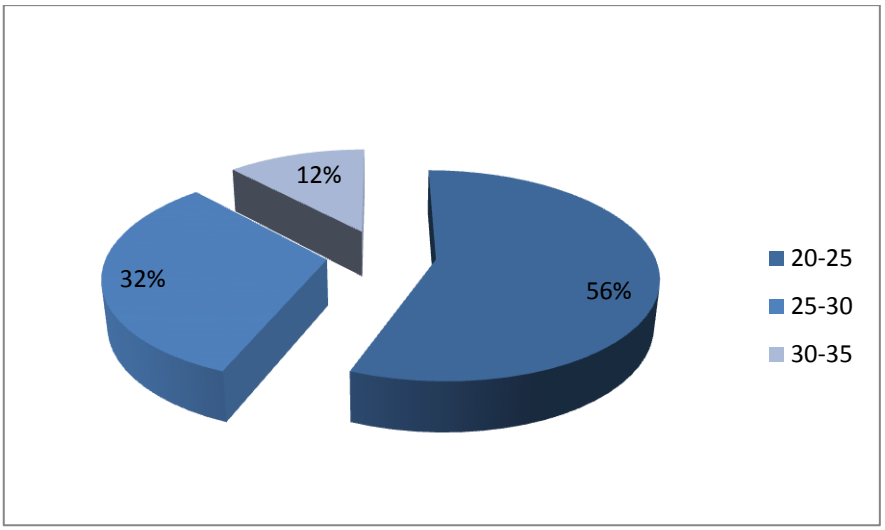


CHART - 8

BMI and Hernias



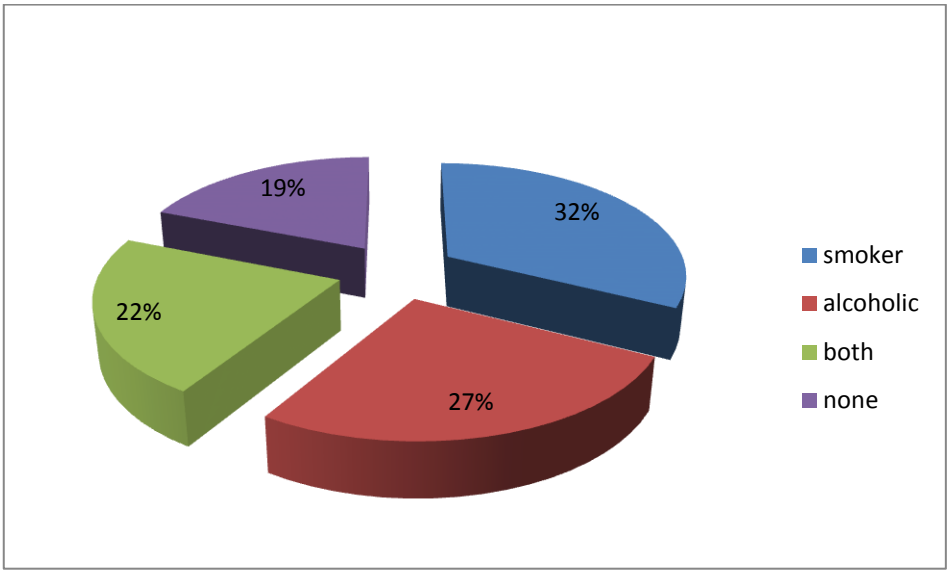
32% of the patients had BMI 20 – 25.

56% of the patients had BMI 25-30.

12% of the patients had BMI 30 – 35.

CHART - 9

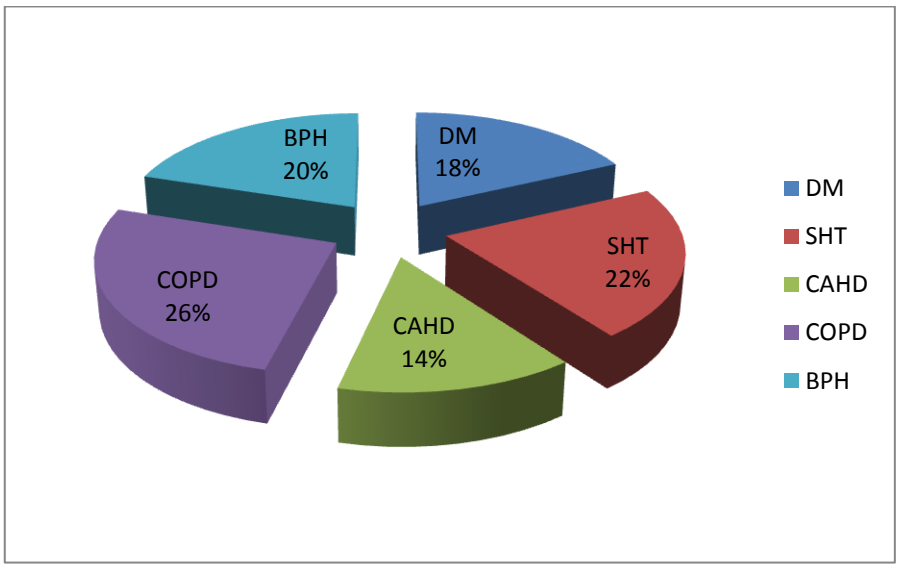
Smoking, Alcoholism and Hernias



In our study 32% of the patients are smokers , 27% are alcoholics. 22% are both smoker and alcoholic and 19% of the patients are nonalcoholic and nonsmokers .

CHART - 10

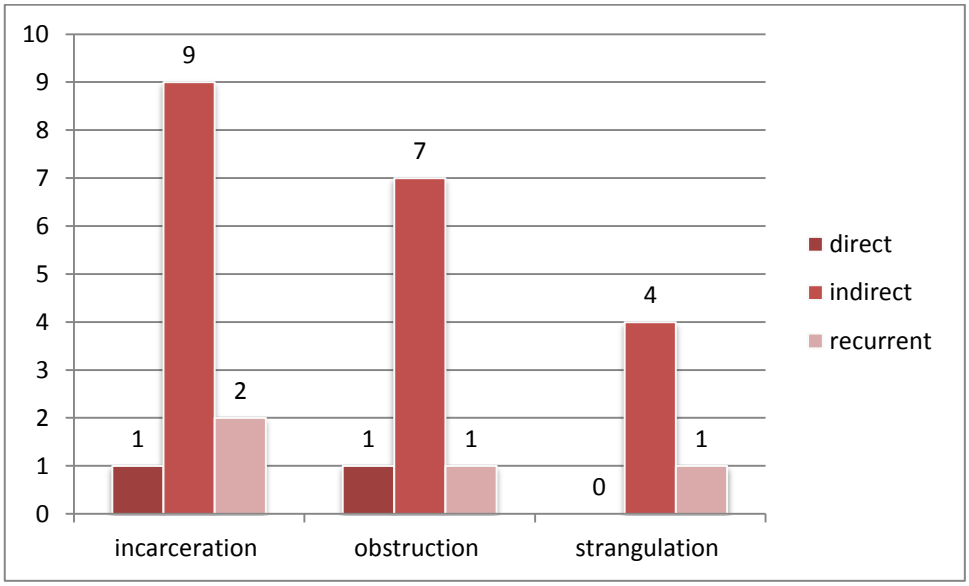
CO-MORBID ILLNESS AND HERNIAS



18% (36)of the patients had diabetes mellitus . 22%(43) of the patients had systemic hypertension . 14% (28) of the patients had coronary artery heart disease. 26% (52) of the patients had chronic obstructive pulmonary disease. 20% (40)of the patients had benign prostatic hypertrophy.

CHART - 11

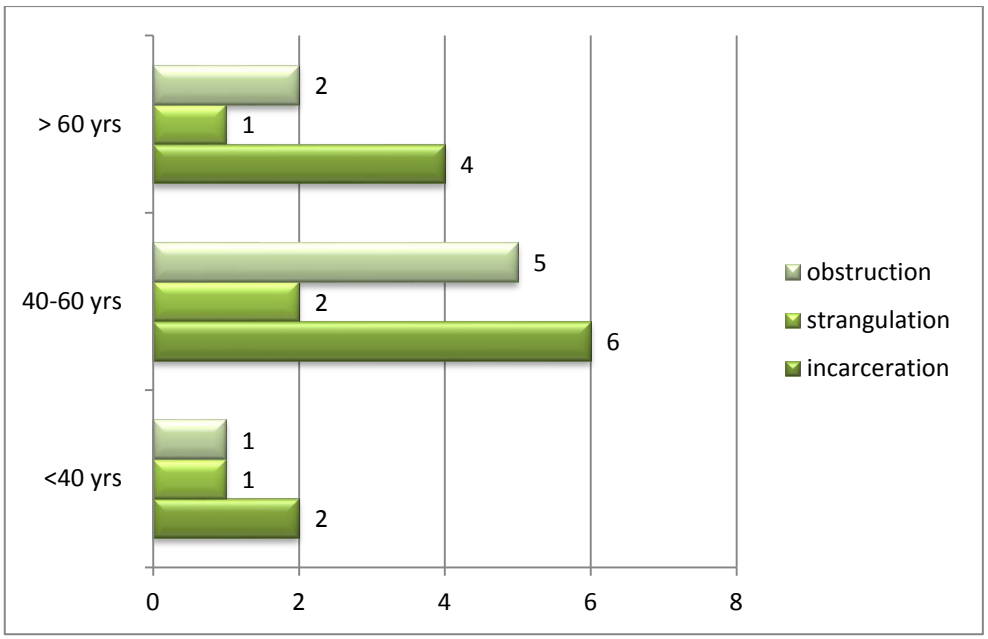
PRE-OP COMPLICATIONS



50% (12) of the of the pre-operative complications was due to incarceration. 33%(8) of the pre-operative complications was due to obstruction . 17% (4) of the complications was due to strangulation.

CHART - 12

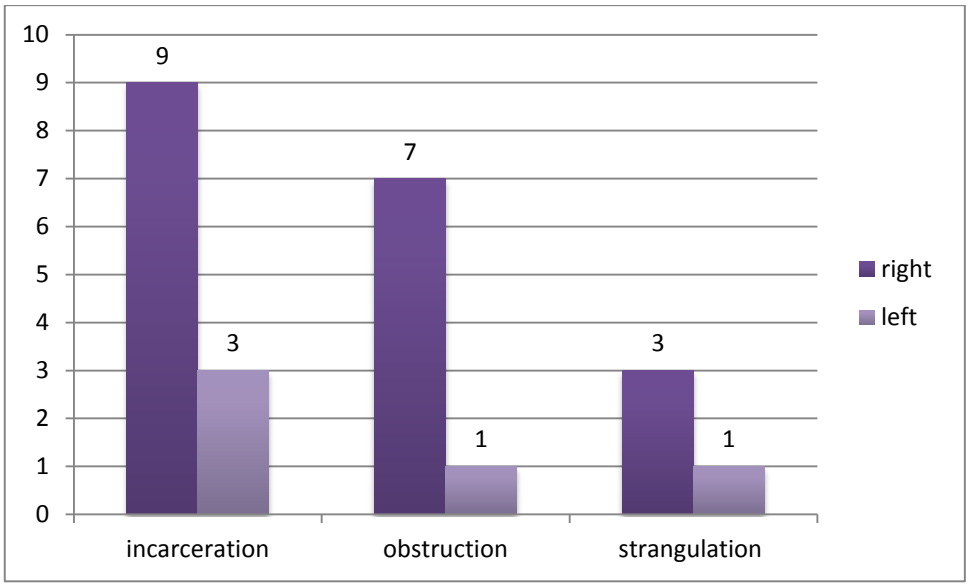
Agewise Pre-Op Complications



17%(4) of the patients are less than 40 years old. 54%(13) of the patients are in the age group of 40 – 60 years. 29%(7) of the complications are in the age group of more than 60 years.

CHART - 13

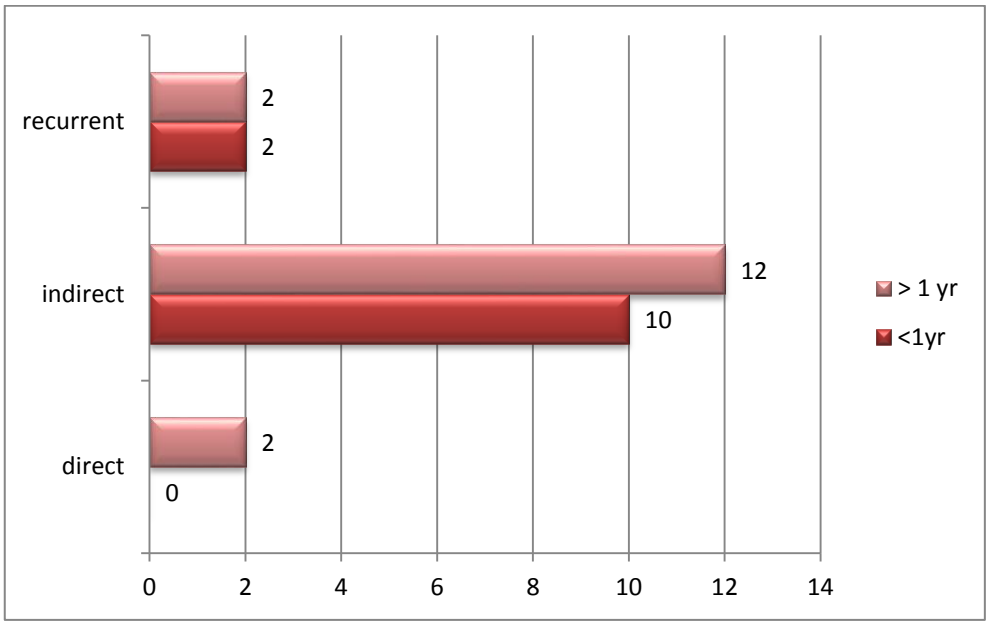
Side Wise Pre-Op Complications



75% (9) of the incarcerated hernia are right inguinal hernia. 25% (3) of the incarcerated hernia are left inguinal hernia . 87.5%(7) of the obstructed hernias are right inguinal hernia. 12.5%(1) of the obstructed inguinal hernia are left inguinal hernia. 75% (3) of the strangulated hernias are right and 25%(1) of the strangulated hernias are left.

CHART - 14

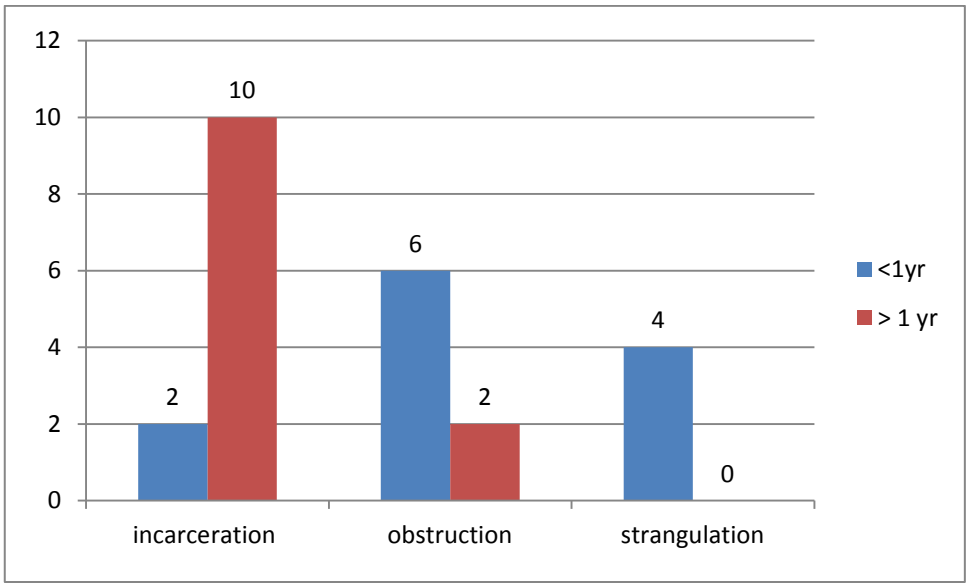
Duration of Hernia and Preop Complications



58%(14) of the complicated hernias had hernias for more than one year. 42%(10) of the complicated hernias had hernia for less than one year.

CHART - 15

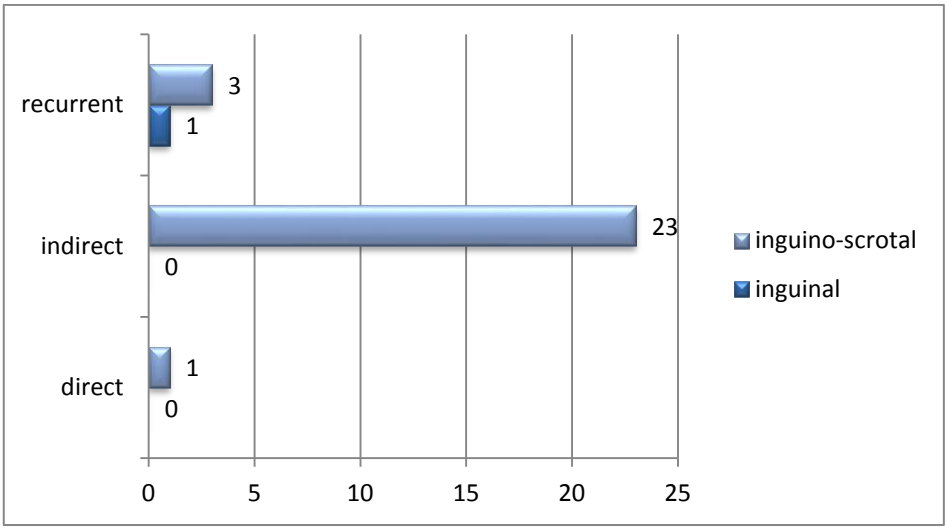
Duration of Hernia and Preop Complications



83%(10) of the incarcerated hernias had hernia for more than one year. 17%(2) of the incarcerated hernias had hernia for less than one year. 75%(6) of the obstructed hernias had hernia for less than one year, and 25%(2) of the obstructed hernias had hernia for more than one year. 100%(4) of the strangulated hernia patients had hernia for less than one year.

CHART - 16

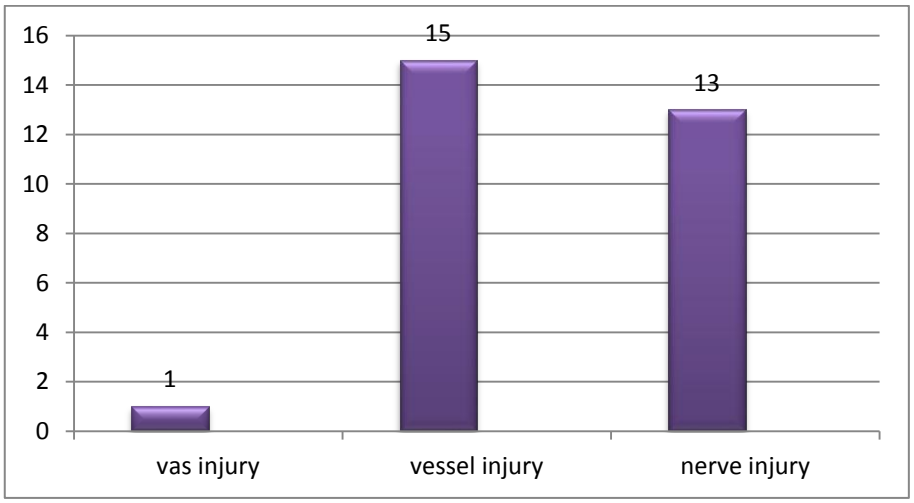
Types of Complicated Hernias



96% (23) of the complicated inguinal hernias are inguino scrotal. 4%(1) of the pre-operative complications had bubonocele.

CHART – 17

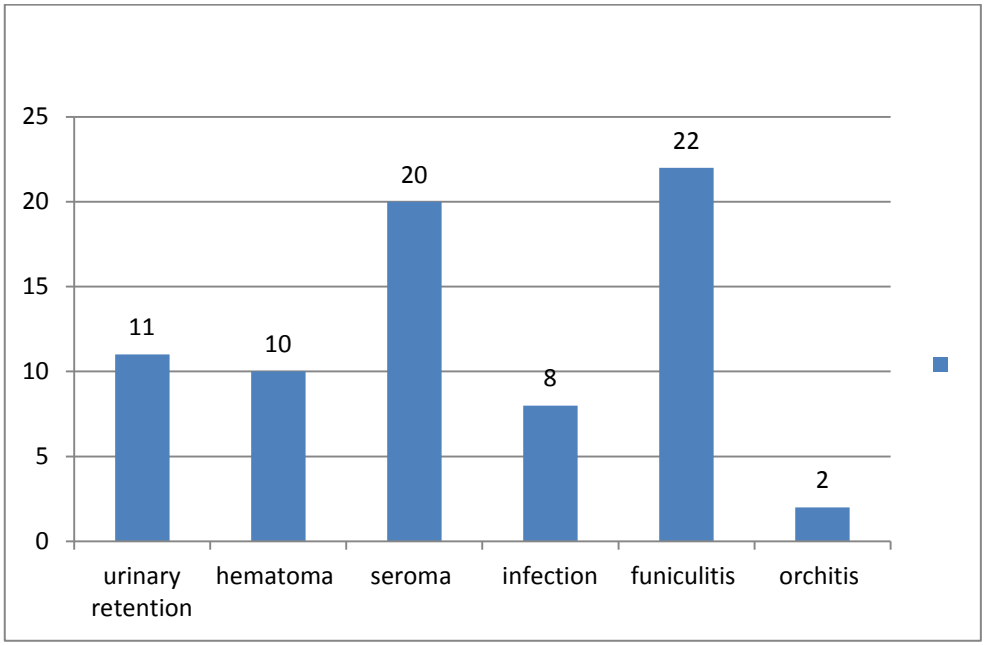
Intra-Op Complications



0.7% (1) of the complications are vas injury. 11%(15) of the complications are vessel injury. 9%(13) of the complications are nerve injury.

CHART – 18

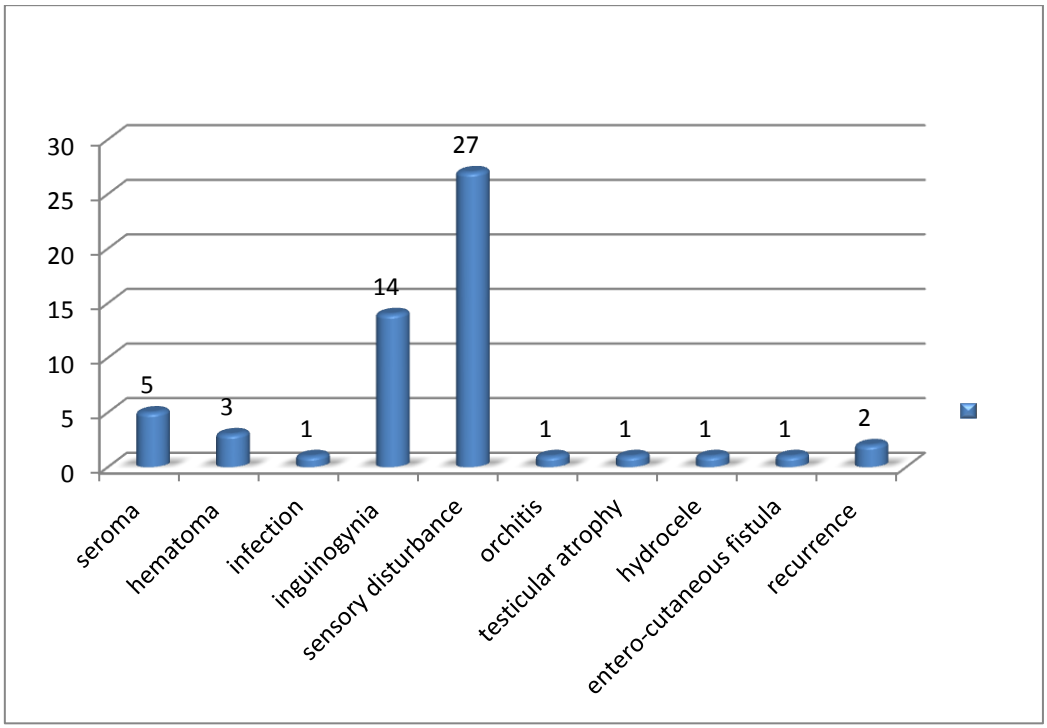
Short Term Complications



8%(11)of the complications are due to urinary retention . 7%(10) of the complications are due to hematoma . 14%(20) of the complications are due to seroma.6%(8)of the complications are due to wound infection. 16%(22)of the complications are to funiculitis . 1%(2) of the patients are due to orchitis .

CHART – 19

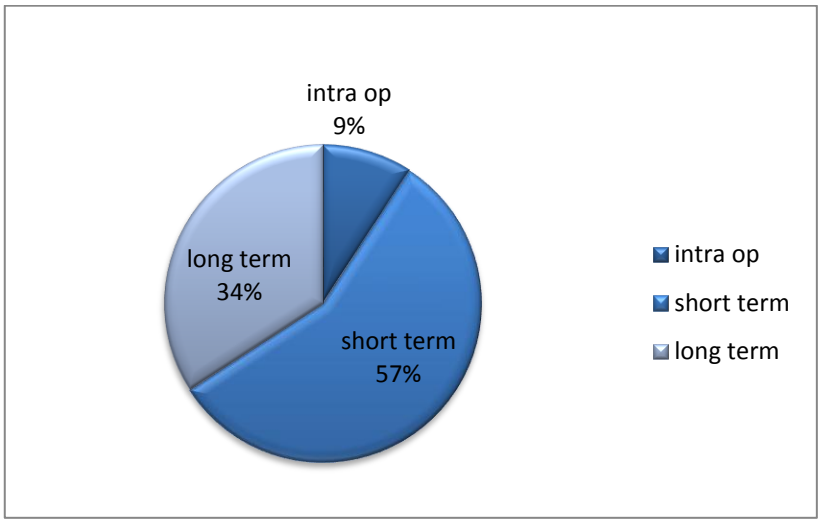
Long Term Complications



3.6%(5) of the complications are due to seroma. 2%(3) of the complications are due to hematoma . 0.7%(1) of the complication are due to infection. 10%(14) of the complications are due to inguinodynia. 19.4%(27) of the complications are due to sensory disturbance. 1.4%(2) of the complications are due to recurrence. Orchitis, testicular atrophy , hydrocele , entero-cutaneous fistula each contribute to 0.7% of the complications each.

CHART – 20

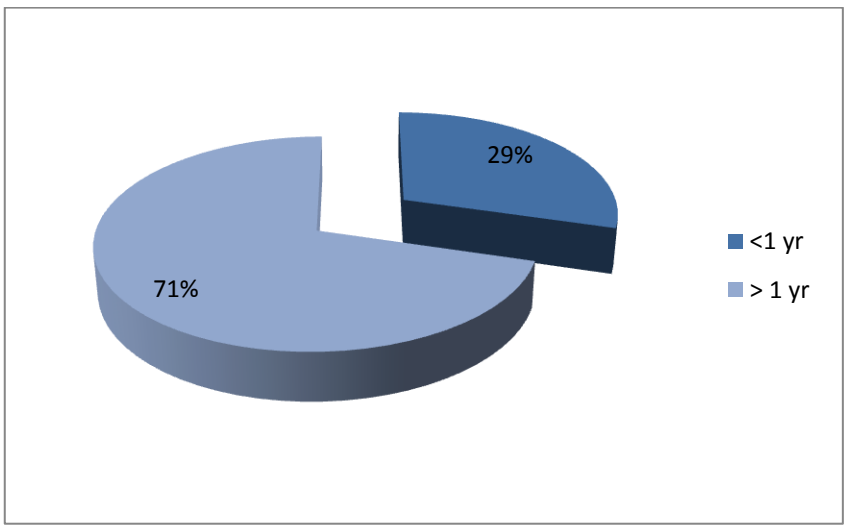
Post-Op Complications



9% of the complications are intra ope rative, 57% of the complications are short term complications . 34% of the complications are long term complications.

CHART – 21

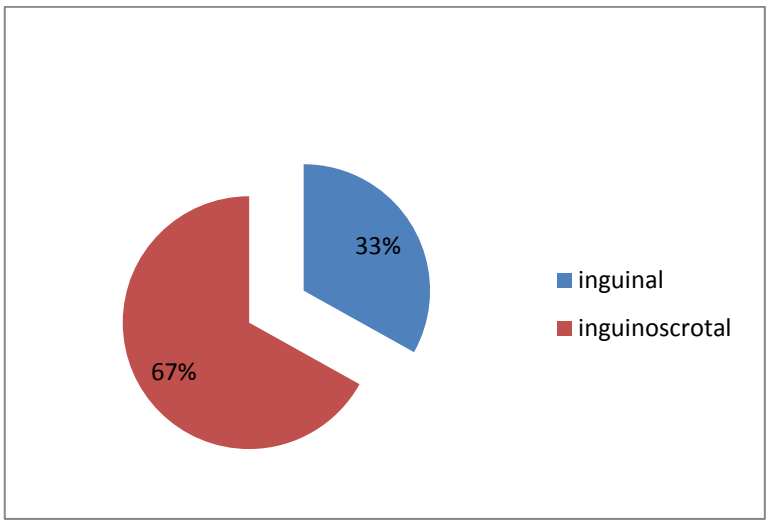
Duration of Hernia and Postop Complications



71% of the complications occurred in patients with hernia more than one year. 29% of the complications occurred in patients with hernia less than one year.

CHART – 22

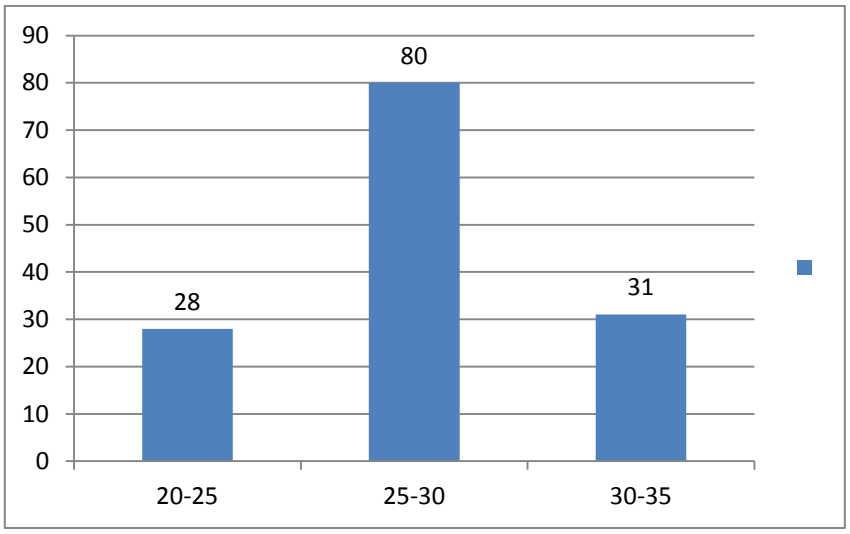
Type of Hernia and Postop Complications



67% of the complications occurred following repair of inguino scrotal hernias. 33% of the complications occurred following bubonocele repair.

CHART – 23

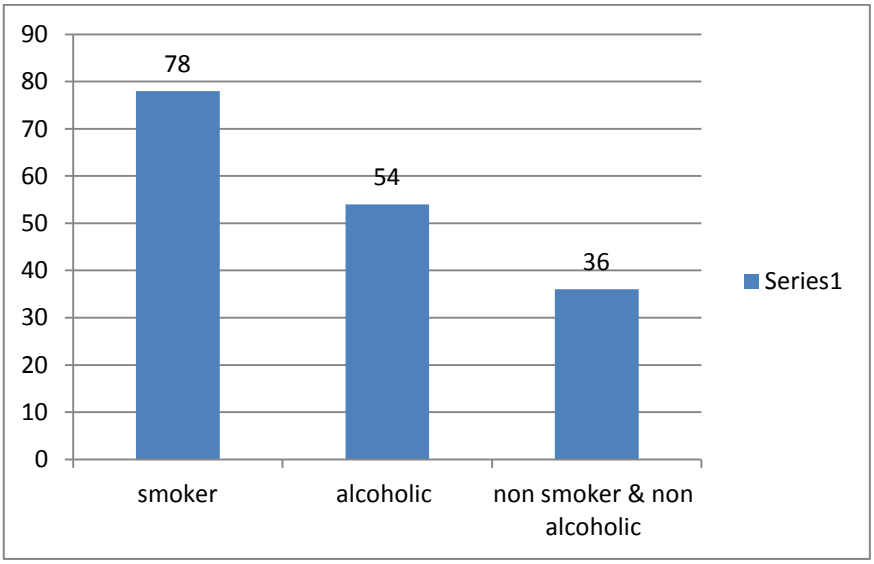
BMI and Postop Complications



20%(23) of the complications occurred in patients with BMI 20-25. 58%(80) of the complications occurred in patients with BMI 25 30.22%(31) of the complications occurred in patients with BMI 30-35.

CHART – 24

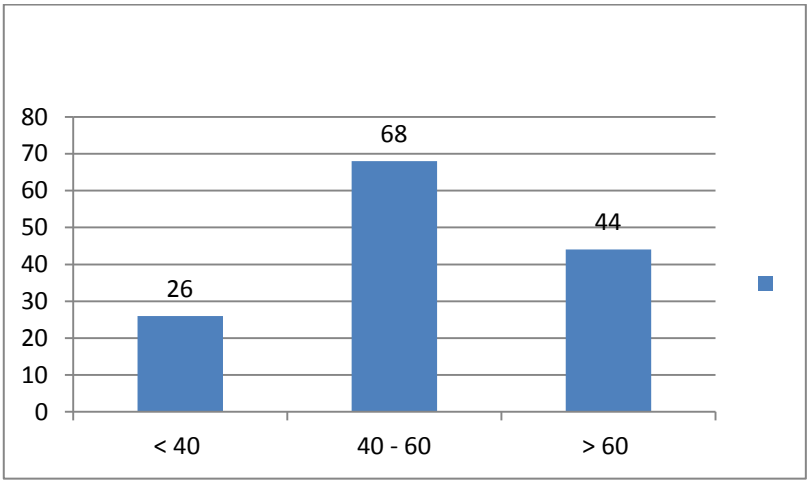
Smoking Alcoholism and Postop Complications



56% (78) of complications occurred in smokers. 39%(54) of the complications occurred in alcoholic. 26%(36) of the complications occurred in patients who do not smoke or drink.

CHART – 25

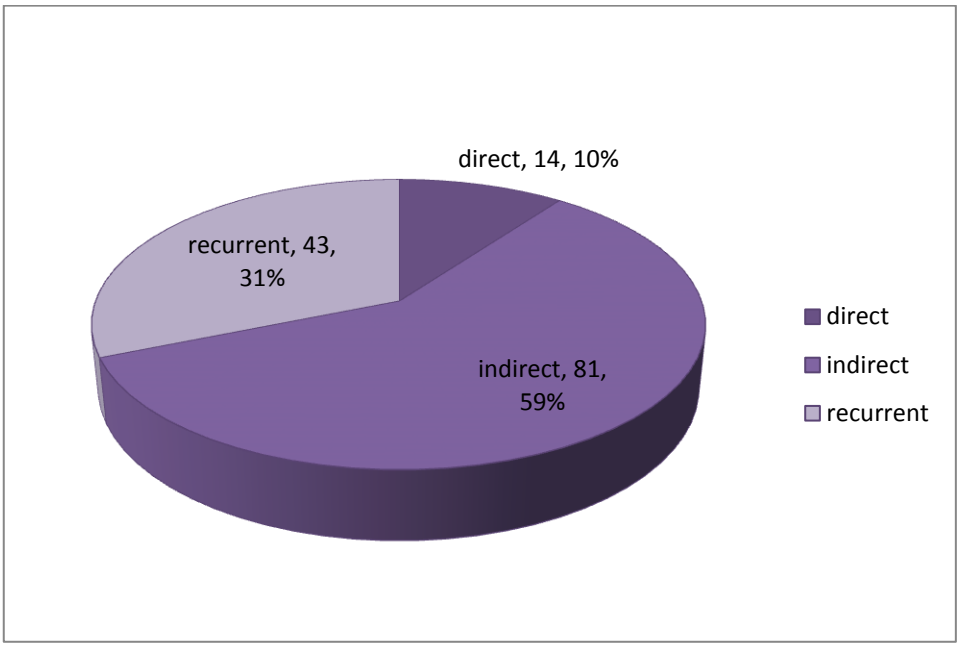
Age Distribution of Postop Complications



19%(26) of the complications occurred in patients less than 40 years of age. 49%(68) of the complications occurred in patients who are 40 -60 years of age. 32%(44) of the complications occurred in patients more than 60 years.

CHART – 26

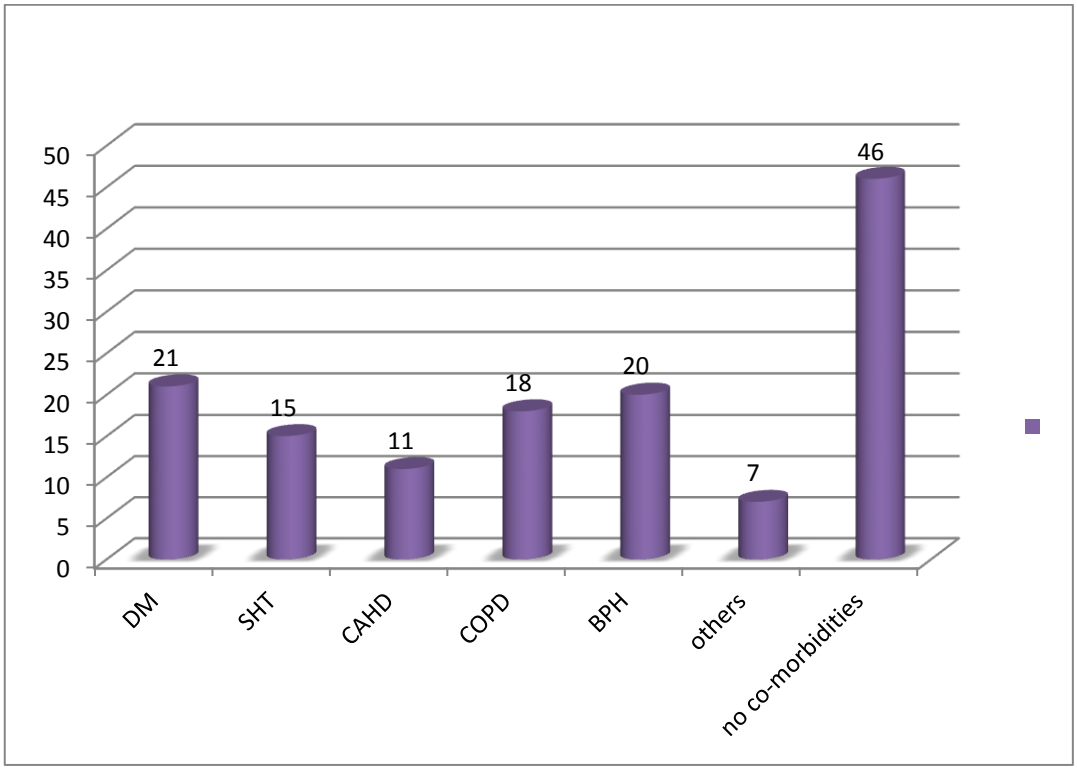
Type of Hernia and Postop Complications



59%(81) of the complications occurred in indirect hernias. 31%(43) of the complications occurred in patients with recurrent inguinal hernia. 10%(14) of the complications occurred in patients with direct inguinal hernia.

CHART – 27

Co-Morbid Illness and Postop Complications



15%(21) of the complications occurred in patients with diabetes mellitus. 11%(15) of the complications occurred in hypertensive patients . 8%(11) of the complications occurred in patients with coronary artery heart disease. 13%(18) of the complications occurred in patients with chronic obstructive pulmonary disease. 14%(20) of the complications occurred in patients with Benign prostatic hypertrophy. 5%(7) of the complications occurred in patients with other co-morbidities. 33% (139) of the complications occurred in patients without any co-morbid illness.

DISCUSSION

In our study a total of 200 patients were evaluated, treated followed up for a period of 2 years .Out of 200 patients 196 patients are males 4 patients are females .Among the 4 female patients 1 patient had a direct inguinal hernia and 3 patients had indirect inguinal hernia. All the female patients had right sided inguinal hernias, and had symptoms for less than one year and did not have any pre-op or post-op complications

Out of the 196 male patients 24 patients presented with pre-operative complications like incarceration, strangulation or obstruction and are treated on an emergency basis . Modified Bassini's hernia repair was used for all these patients with pre-op complications. The other 172 patients are treated electively by Lichenstein's tension free mesh repair using a polypropylene mesh.

Out of the 200 patients 52 (26%) are less than 40 years old, 99 (49.5%) are in the age group of 40 -60 years, 49 (24.5%) are in the age group of more than 60 years. Majority of patients included in our study are 40 to 60 years of age.

54 patients (27%) had direct inguinal hernia, 146 (73%) had indirect inguinal hernia, 12(6%) had recurrent inguinal hernia, 8 patients (66%) had direct recurrence and 4 patients (33%) had indirect recurrence.

86patients (43%) had their hernias confined to the inguinal canal , and 114 patients (57%) had inguino-scrotal swelling.139 patients (69.5%) had right inguinal hernia, 61 patients (30.5%) left inguinal hernia. 14 patients(7%) had bilateral inguinal hernia, most of the bilateral inguinal hernia patients are more than 60 years old and most of the bilateral inguinal hernias are direct .21 patients (10.5%) had pantaloons hernia. These data are supported by Nyhus and Codons text book of hernia. 126 patients (63%) patients had smoking habit and most of these patients had direct inguinal hernias or a pantaloons hernia. 103 patients (51.5%) are alcohol users, and majority of them are 40 – 60 years of age . 86 patients (43%) are both alcoholic and smokers. 74 patients (37%) are non-smokers and non-alcoholic.

Out of 200 patients 80 (40%) had one or more co-morbid illness , and majority of the patients are above 40 years of age , majority of the patients with Benign Prostratic Hypertrophy are more than 60 years of age . Most of the patients with co-morbid illness are in the age group of 40-60 years, and had more than one co-morbidity.

Out of 200 patients, 92 (46%) reported within one year after the onset of the symptoms. Among them 23(33%) had direct inguinal hernia 69 patients (66%) indirect inguinal hernias and 3 patients had recurrent inguinal hernia . 108 patients (54%) had symptoms for more than one year (up to 15 years) of which 30% are direct type, and 70% are indirect type.

Pre Operative Complications

Out of 200 patients, 24(12%) had pre- operative complications and presented with acute symptoms . 4 patients (17%) had recurrent inguinal hernia, and the remaining 20 patients (83%) had primary inguinal hernia. 20 patients (80%) had right inguinal hernia , and 4 patients (30%) left inguinal hernia.1 patient (4%) had direct inguinal hernia, and remaining 23 patients (96%) had indirect inguinal hernias. Three types of complications are encountered in our study. They are incarceration, strangulation and obstruction. 96% of the complicated inguinal hernia are inguino-scrotal type of hernia[22, 20, 32, 34,]

Incarceration was the most common pre-op complication 12 patients (50%) . patients in the age group of 40 -60 years are commonly affected 8patients (66%), followed by patients in >60 age group 4 patients (33%), and patients in <40 years age group, 2patients (17%). 9 patients (75%) with incarceration had right inguinal hernia, 3 patients (25%) had left inguinal hernia, 2patients (17%) had recurrent inguinal hernia, of them one patient had direct and one patient had indirect inguinal hernia [1,22,32,34].

Obstruction was the 2nd common complication in our study 8 patients (33%) .Patients in 40-60 years age group are commonly affected, 5 patients (62.5%) , followed by patients in > 60 age group, 2 patients (25%) and by patients in > 40 years age group, 1 patient(12.5%). One patient 12.5% had recurrent inguinal hernia.[1,22,32,34]

Strangulation was the 3rd common complication in our study 4 patients (17%). They either required resection and anastomosis or application of warm pads intra-operatively.50% (2 patients) of the strangulated inguinal hernias are in the age group of 40 -60 years . 25% , 1patient each in the < 40 years age group and > 60 years age group . [1,22,32,34]

8 %(2 patients) of the complicated inguinal hernias are of direct type , and 22 patients (92 %) are of indirect type . 83% of the with incarceration had inguinal hernias for more than one year duration. Majority of patients in strangulation and obstruction group had inguinal hernias for less than one year duration. [1,22, 32]

80% of the patients with pre-operative complications are smokers and had history of chronic cough or constipation in their recent past. This is supported study by Read et al and David Langston et al.[1, 28,36]

In view of the morbidity associated with the complications , inguinal hernias should be operated at the earliest. But controversies exist over this topic as to whether to operate or not to operate on patient with asymptomatic hernia. Alvarez JA et al study on inguinal hernia complications suggests to operate inguinal hernias as and when diagnosed in view of the associated morbidities . Klinik fur et al study on expenditure and disabilities caused by the treatment of the uncomplicated suggests not to operate on asymptomatic hernias unless complicated .Vanden Henvel B et al studied complicated hernias ,and suggested that

watchful waiting is cost effective for asymptomatic hernias . Rai S et al studied the risk factors associated with pre-operative complications of hernias. El Rashid et al suggests elective surgery for inguinal hernias considering the risk of complications.[22]

Out of 200 patients included in our study 62 patients developed post-operativecomplications. Some patients had more than one complication. There are 139 complications in 62 patients during a 2 year follow-up[22,32]

Intra Operative Complications

In our study 15 patients had intra -operative complications .Three complications were encountered in our study, they are vas injury, vessel injury, nerve injury.

Blood vessel injury (3 patients)contributes 2% of all intra operative complications . Pampiniform plexus is commonly injured. Blood vessel injury is common during the repair of long standing hernias due to adhesions between the sac and the cord and in large inguino-scrotal hernias due to extensive dissection involved in the dissection of the sac. Vessel injury is less frequent during direct hernias repair. [28,36,37]

Nerve injury is the most common intra operative complication, (11 patients) contributing to 9% of all post-operative complications. Ilio inguinal nerve is the commonly injured nerve followed by the ilio hypogastric nerve and the genital branch of the genito femoral nerve. Rab

M et al studied anatomical variations associated with the inguinal nerves. Ergul et al studied and proved that a thorough anatomical knowledge of the nerves can help to reduce the incidence of intra- operative nerve injury. Hakeem A et al studied the cause for inguinodynia and suggested careful handling of nerves to prevent post operative inguinodynia. [29,36,19]

Vas injury is uncommon and contributed to 0.7 % 0f all the post operative complications (1 patient). In our study vas injury occurred in one patient during the repair of the associated recurrent inguinal hernia, post operative decrease in sperm count or infertility was not assessed as the patient was 75 years old. Silich et al studied the formation of sperm granuloma due to vas injury during repair of inguinal hernia. Forte et al did a study on post operative complications and reported similar complications.[39,42]

Sheynkin et al studied iatrogenic vas injury and concluded that inguinal hernia repair is the most common cause for vas injury and the treatment of the obstructive azoospermia is unsatisfactory.[42]

Short Term Complications

It includes complications that occurred from immediate post operative period up to three months duration.

Out of all complications funiculitis was the the most common short term complication. It contributes to 15% of all post operative complications (22 patients). It is commonly observe in patients with long

standing hernia , inguino scrotal hernia. Incidence of this complication is very less in patients with direct inguinal hernias.

Post operative urinary retention contributes to 7% of all the postoperative complications (11 patients). Majority of this complication occurred in patients in the age group of > 60 years and had associated Benign Prostratic Hypertrophy. The rest of the patients had prolonged surgery due to varied reasons.

Haematoma contributes to 7% of all the post operative complications (10 patients). 50% of the patients with hematoma are hypertensive and had BMI[16] more than 25. 20 % (2 patients) had large hematomas and required exploration under anaesthesia and securing of hemostasis. The remaining 80% of the patients are managed conservatively. 30% (3 patients) had persistant hematoma lasting for more than 3 months . Forte et al studied the post operative complications of hernia repair and reported similar complication incidence. [37]

Seroma was the second common complication in our study contributing to 10% of all post operative complications (15 patients). 20% 0f the seromas are large and symptomaticrequiring aspiration or drainage . 2 patients had recurrent seroma requiring aspiration more than once . 5 patients (30%) had seromas persisting for more than 3 months. patients in the age group of 40 - 60 years are more commonly affected by seroma. Majority of patients with sarcoma had BMI> 25. 80% of the seromas are managed conservatively. [31,36]

4% (8 patients) had wound infection. 5 % (1 patient) had persisting infection requiring removal of the mesh. 95% (7 patients) of the wound infection are managed conservatively. 90% of the patients with wound infection had BMI > 25. 60% of the wound infection occured in patients with diabetes mellitus. One patient developed wound infection after 3 months due to secondary infection of the haemotoma . It was managed conservatively. [19,28,35, 36.]

Orchitis contributes 1.4% (2 patients) of all the post operative complications. One patient surgery done for recurrent inguinal hernia and the other patient had long standing complete inguinal hernia.The patient who underwent recurrent inguinal hernia repair had persistant orchitis and ended up in testicular atrophy[30, 38]

Testicular atrophy (1 patient) contribute to (0.7%) of the complications[36]

Bulus et al studied the effect of Lichenstein's mesh repair on the testicular blood supply and concluded that loss of the testicular blood supply is insignificant. [38]

Long Term Complications

Complications which appeared three months after surgery , or those complicatioins which persisted beyond three months are included in this group. 40% of the post operative complications are long term complications. 4% 0f the patients had long term complications.

3% (5patients) of complications are seromas. All these patients required repeated aspiration of the seroma. All the seromas got cured within 6 months duration.[31, 36, 19,28]

3 patients (0.15 %) had hematoma persisting for more than 3 months . one patient had secondary bacterial infection of the haemotoma . All these patients were managed conservatively. [36, 37]

0.5% (1patient) had wound infection due tosecondary bacterial infection of the haemotoma, which was managed conservatively with first generation cephalosporins based on the culture sensitivity reports.[36]

7% of the patients had chronic groin pain, which contributed to 10 % of all the post operative complications. 74% of the inguinodynia patients are treated only by reassurance and 24% of the patients required analgesics, and none of the patients required surgery for inguinodynia. Easwang et al studied the incidence and management of post operative inguinodynia. [17,26]

27 patients (13.5%) had sensory disturbances over the groin, medial aspect of the upper thigh and scrotum . This contributes to 19 % of all the post operative complications . Hakeem et al , pradeep saxena et al studied this complication .[36, 26, 17]

0.5% (1 patient) had persistent orchitis. This contributes to 0.7% of all complications. This patient was operated for recurrent inguinal hernia which he had for seven years .This patient ended up in testicular

atrophy(0.7%). Forte A et al studied the post operative complications of inguinal hernia repair.Bulus H et al studied the effect of inguinal hernia repair on the testicular blood supply.[36,38]

Hydrocele contributed to 0.7% of all the post operative complications. One patient (0.5%) developed this complication. Magnus Hallen et al and Richard B etal reported such complications in their studies.[36]

1% of the patients had recurrence at the end of 2years follow up. This contributes 1.4% of all complications . One patient had chronic cough as the predisposing factor and the other patient had untreated Benign Prostratic Hypertrophy. Forte A et al studied post operative complications of all the inguinal hernia repair and reported similar incidence rates. Magnus Hallen et al, Richard B et al reported similar incidence rates and risk factors for hernia recurrence. Jansen PL et al reported smoking and family history as the predisposing factors for inguinal hernia recurrence [28,36].

68 complications (49%) occurred in patients in the age group of 40–60 years. 44 complications(37%) occurred in the age group > 60 years. 26 complications (19%) occurred in patients in the age group < 40 years.

81 complications (58%) occurred in patients with indirect inguinal hernia. 43 complications (31%) occurred in recurrent inguinal hernias.

14 complications (10%) occurred in patients with direct inguinal hernia. 70% of the complications occurred in patients with inguino-scrotal swelling. 30% 0f the complications occurred in patients with inguinal swelling. 57 % (80) of the complications occurred in patients with BMI 25 – 30. 22% (31) of the complications occurred in patients with BMI 30 – 35. 20%(28) of the complications occurred in patients with BMI 20– 25 [16]. David Lindston et al and Richard B et al studied the risk factors for post operative complications and reported obesity as an important risk factor for the development of complications.[36, 1]

56% (78) of the complications occurred in smokers. 39%(54) of the complications occurred in alcoholics. 26% (36)of the complications occurred in non smokers and non alcoholics. David Lindston et al, Read et al studied the risk factors for post operative complications and reported smoking as an important risk factor for the development of complications.[1, 36]

71% (98) of the complications occurred in patients who had hernia for more than one year. 29%(41) complications occurred in patients who had hernia for less than one year.[20]

15%(21) of the complications occurred in patients with diabetes mellitus . 11%(15) of the complications occurred in hypertensive patients.8%(11) of the complications occurred in patients with coronary artery heart disease. 13%(18) of the complications occurred in patient with chronic obstructive pulmonary disease. 15%(20) of the

complications occurred in patients with Benign Prostratic Hypertrophy. 33% (46) of the patients had no associated co-morbidities. 5%(7) of the patients had other co- morbidities. Richard D et al studied the risk factors for post operative complications and reported that patients with associated co- morbidities had increased risk for post operative complication.[36]

CONCLUSION

- 31% (62) of the patients developed complications
- Totally 139 complications are reported on follow up of 200 patients for a period of 2 years
- Nerve injury is the most common intra operative complication
- Vascular injury is the 2nd common intra operative complication
- Funiculitis is the most common short term complication in our study
- Funiculitis commonly occurred in patients with inguino- scrotal hernias and in hernias of longer duration
- Seroma is the 2nd common short term complication in our study
- Seroma is common in patients with BMI > 25
- Wound infection is common indiabeticpatients and in patients with BMI > 25
- Haemotoma is common in hypertensive patients and in patients with BMI > 25
- Orchitis, nerve injury, vessel injury are common in recurrent inguinal hernias had in patiets with large inguino scrotal hernias
- Chronic groin pain is common in the age group 40- 60 years.
- Patients with intra operative nerve injury had post operative sensory disturbances in the groin region.
- Smokers had increased incidence of complications than non smokers.

- 1% of the patients had inguinal hernia recurrence.
- Under weight and smoking are important risk factors in the development of recurrence.
- Patients with strangulation or obstruction had hernias for less than one year
- Patients with incarceration had inguinal hernia for more than one year duration
- Incarceration was the most common pre operative complication
- 12% of the patients had pre operative complications
- Incarceration is the most common pre operative complication
- Right inguinal hernias contribute to 80 % of all pre operative complications
- 96 %of the pre operative complications occurred in inguino sctotal hernias.
- Incarcerated hernias commonly occurred in patients with chronic cough and Benign Prostratic Hypertrophy with significant urinary tract obstruction.
- Pre operative complications commonly occurred in patients in the age group of 40 to 60 years

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PROFORMA

Name: IP.NO: DOA:

Age: DOS:

Sex: DOD:

Occupation:

Address:

Presenting complaints:

Duration of presenting complaints:

H/o presenting illness:

Swelling

Pain

Reducibility

Vomiting:

Abdominal distension

Constipation/ obstipation

Chronic cough

Urinary symptoms

Bowel symptoms

Past history

Previous surgeries

Family history

Smoking

Alcoholism

Diabetes mellitus

Other co-morbid illness

Socioeconomical status:

General examination:

Built and nourishment:

Hydration:

Fever:

Anaemia:

Pedal edema:

Jaundice:

Generalised lymph nodes:

Pulse:

BP:

Systemic examination

CVS:

RS:

CNS:

ABDOMEN:

Groin

Inspection :

- Shape
- Size
- Position
- Extent
- Other Hernial orifices
- Genitalia

Palpation:

- Tenderness
- Consistency
- Reducibility
- Cough impulse

Deep ring occlusion test

3 finger test

Finger invagination test

Malgaigne bulge

Opposite groin

External genetalia

Percussion:

Auscultation:

PR:

Provisional diagnosis:

Investigations

Blood investigations:

Hb:

TC:

DC: P: L: E: B: M:

ESR:

Blood . Urea: Serum . Creatinine.: serum electrolytes :

HIV:

HbsAg:

LFT:

	TP:	Alb:	Glob:
	TB:	Direct:	Indirect:
	SGOT:	SGPT:	ALP:
Urine:	Alb:	Sugar:	Deposits:

CXR:

AXR :

USG abdomen:

USG groin :

Treatment:

Elective :

Emergency :

Lichenstein ‘s repair / modified Bassini’s repair

Intra op complications :

Short term Complications:

Follow – up :

2 weeks
3 months
1 year
2 year

Remarks:

CONSENT FORM

I _____ IP.NO _____in my full senses hereby give my complete consent for _____

Or any procedures deemed fit which is a /and diagnostic procedure / biopsy / transfusion/medication / operation to be performed on me / my daughter/ my ward_____ age _____ under any anaesthesia deemed fit. The nature and risk involved in the procedure have been explained to me, to my satisfaction. For academic and scientific purpose, the operation / procedure may be televised or photographed.

Place: Signature/Thumb impression
Date: of the patient/ guardian

Guardian :

Relationship :

Address :